A G E N D A
JAMES CITY COUNTY BOARD OF SUPERVISORS
READING FILE
County Government Center Board Room
101 Mounts Bay Road, Williamsburg, VA 23185
June 14, 2016
6:30 PM

A. FOR YOUR INFORMATION

1. Draft Bacteria TMDL Action Plan for Powhatan, Mill and Skiffes Creeks

ITEM SUMMARY

DATE:	6/14/2016
TO:	The Board of Supervisors
FROM:	Frances C. Geissler
SUBJECT:	Draft Bacteria TMDL Action Plan is available for review and public input from June 15 through July 15, 2016.

ATTACHMENTS:

	Description	Type
🗋	Memorandum	Cover Memo
🗋	Draft Bacteria TMDL Action Plan Summary	Backup Material
🗋	Draft Powhatan, Mill and Skiffes Creeks Bacteria TMDL Action Plan	Backup Material

REVIEWERS:

Department	Reviewer	Action	Date
Stormwater	Geissler, Fran	Approved	5/20/2016 - 12:02 PM
General Services	Horne, John	Approved	5/20/2016 - 1:50 PM
Publication Management	Boles, Amy	Approved	5/20/2016 - 1:59 PM
Legal Review	Kinsman, Adam	Approved	5/31/2016 - 8:30 AM
Board Secretary	Fellows, Teresa	Approved	5/31/2016 - 9:08 AM
Board Secretary	Purse, Jason	Approved	6/3/2016 - 8:46 AM
Board Secretary	Fellows, Teresa	Approved	6/3/2016 - 9:48 AM

M E M O R A N D U M

DATE: June 14, 2016

TO: The Board of Supervisors

FROM: Frances C. Geissler, Stormwater Director

SUBJECT: Draft Bacteria Total Maximum Daily Load Action Plan for Powhatan, Mill and Skiffes Creeks

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James City County's Municipal Separate Storm Sewer System (MS4) Permit, No. VAR040037, requires the County to prepare an Action Plan to address specific bacteria Total Maximum Daily Loads (TMDLs) no later than June 30, 2016, and submit the plan to the Virginia Department of Environmental Quality (DEQ) no later than September 30, 2016. The specific bacteria TMDLs included in this requirement are for Powhatan, Mill and Skiffes Creeks. This effort is in addition to the requirement to develop the Chesapeake Bay TMDL Action Plan that was submitted to the DEQ in September 2015 and approved February 22, 2016.

The Bacteria TMDL Action Plan must provide a review of the County's current MS4 program, identify the regulated portion of the County included in the TMDLs and describe the means and methods the County will use to accomplish the reductions. The Permit also requires the County to solicit public input on the proposed plan prior to submission.

Similar to the County's Chesapeake Bay TMDL Action Plan, this draft Bacteria TMDL Action Plan for Powhatan, Mill and Skiffes Creeks was developed by Whitman, Requardt & Associates, LLP, and is based on previous and on-going efforts the County has undertaken to reduce bacteria in County waterways as well as the recently approved Chesapeake Bay TMDL Action Plan.

Tomorrow, June 15, 2016, is the beginning of the required public input process for the Plan, which will continue through July 15, 2016. Upon completion of the public input period, the Plan will be finalized for submission to the Virginia DEQ no later than September 30.

FCG/ab
BacteriaTMDLPlan-mem

Attachment

Bacteria TMDL Action Plan for Powhatan, Mill, and Skiffes Creek- Program Summary

BMP	BMP Description	Measurable Goal	Metric	Responsible Party	Timeline	Associated Document	Status
SC-1	**Bacteria TMDL Action Plan for Powhatan, Mill, and Skiffes Creek**	**DevelopTMDL Action Plan for Powhatan, Mill, and Skiffes Creek**	**Action Plan Developed**	**Stormwater Division**	**PY 3**	**Bacteria TMDL Action Plan for Skiffes, Powhatan and Mill Creeks**	**Included in this annual report**
SC-1.1	**Develop and maintain a list of its legal authorities such as ordinances, state and other permits, orders, specific contractlanguage, and inter-jurisdictional agreements applicable to reducing the pollutant identified in each applicable WLA**	**Conduct annual review of policies**	**Complete policy review and update list submitted in annual plan**	**Stormwater Division**	**annually**	**County Ordinance "The Virginia Stormwater management program Ordinance"**	**on-going**
SC-1.2	**Develop and maintain an updated list of all additional management practices, control tecniques and system design and engineering practices beyond those in Section II B that have been implemented as part of the MS4 program that are applicable to reducing "Bacteria"**	**Compile a list of accomplishments and submit in annual reports**	**Submittal of list in annual Report**	**Stormwater Division**			**on-going**
SC-1.2.1	Pet Waste Program	Continue istalling pet waste stations at park and open spaces within the watersheds	Number in Service	Stormwater Division	annually	GIS Layer	on-Going
SC-1.2.2	Pet Waste Program	Continue offering pet waste stations free of charge to neighborhoods within the watersheds	Number in Service	Stormwater Division	annually	GIS Layer	on-Going
SC-1.2.3	Coliscan monitoring	Continue ColiScan monitoring of selected sites within the watersheds	Number of sites monitored	Stormwater Division	annually	Complete Annual Report with results	on-Going
SC-1.2.4	Coliscan monitoring	Coordinate and support volunteer monitors to enhance coverage of Coilscan monitoring	Number of sites monitored	Stormwater Division	PY4	Complete Annual Report with results	on-going
SC-1.2.5	BMP retrofit program	Feasibility study of retrofitting County BMPs for bacteria reduction	Complete inventory	Stormwater Division	PY5	Table of retrofits, cost estimates and implementation schedule	Complete in PY 5
SC-1.2.6	Chesapeake Bay TMDL Action Plan projects	Implement projects listed in plan	Projects constructed	Stormwater Division	PY4	Chesapeak Bay TMDL Action Plan	on-going
SC-1.3	**Enhanced public outreach program and employee training programs to also promote methods to eliminate and reduce discharges of "Bacteria"**	**Compile list of activiites and submit in Annual Report**	**List submitted in annual report**	**Stormwater Division**			**on-going**
SC-1.3.1	Enhanced employee training program	Add specific information on bacteria contamination and elimination to SWPPs and employee training	update training plan	Stormwater Division	PY5	County SWPPs and training program literature	PY 5
SC-1.3.2	Enhanced public outreach on pet waste	Continue Participation in askHRGreen.com media program	Number of spots and media buys	Stormwater Division	PY4	Annual askHRGreen.com report	on-going
SC-1.3.3	Enhanced public outreach at access sites	Additional signage, fliers, postings at marina and marine related facilities about bacteria pollution and reductions	Document number of fliers posted, announcements made on annual report	Stormwater Division	PY5		on-going
SC-1.4	**Assessment of all significant sources of bacteria from County facilities**	**Complete assessement of County facilities in regulated areas to identify all municipal facilities that may be considered a significant source of bateria**	**Completed survey included in annual report**	**Stormwater Division**	**PY 4**		**Complete in PY 4**

Powhatan, Mill and Skiffes Creek TMDL Action Plan

James City County, VA

2016.05.15

Draft Report

Powhatan, Mill and Skiffes Creek TMDL Action Plan

Prepared for:

James City County
Stormwater Division
113 Tewning Road
Williamsburg, VA 23185

Prepared By:

Whitman Requardt and Associates, LLC
11870 Merchants Walk
Newport News, VA 23606

Draft Report

May 15, 2016

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Acronyms

BMP	Best Management Practice
BST	Bacterial Source Tracking
CBPA	Chesapeake Bay Preservation Act
DCR	Department of Conservation and Recreation
DEQ	Department of Environmental Quality
EPA	Environmental Protection Agency
HRSD	Hampton Roads Sanitation District
JCC	James City County
JCSA	James City Service Authority
LA	Load Allocation
MOS	Margin of Safety
MCM	Minimum Control Measure
MS4	Municipal Separate Stormwater Sewer System
MS4 Operator	James City County
NPDES	National Pollutant Discharge Elimination System
PSA	Public Service Announcement
RWWMP	Regional Wet Weather management Plan
SESC	Soil Erosion and Sediment Control
TMDL	Total Maximum Daily Load
USEPA	U.S. Environmental Protection Agency
VDEQ	Virginia Department of Environmental Quality
VDH	Virginia Department of Health
VDOT	Virginia Department of Transportation
VSMP	Virginia Stormwater Management Program
VPDES	Virginia Pollutant Discharge Elimination System
WIP	Watershed Implementation Plan: plan developed by the Commonwealth of Virginia to meet the Chesapeake Bay TMDL (pollution diet)
WLA	Waste Load Allocation

1.0 INTRODUCTION

1.1 Purpose

James City County is authorized to discharge stormwater under its General Permit for Small Municipal Separate Storm Sewer Systems (MS4) Permit #VAR040037. The requirements of the permit coverage are codified in 9VAC25-890-40. Section IB "Special conditions for approved Total Maximum Daily Loads (TMDL) …" requires the MS4 operator to address the pollutants in accordance with the requirements of that section where the MS4 has been allocated a waste load in an approved TMDL. Subsection 1 requires the operator to maintain an updated MS4 program plan that includes a specific TMDL Action Plan for pollutants allocated to the MS4.

This document addresses that requirement and serves as the County's MS4 specific TMDL action plan to identify the best management practices and other activities to be implemented to address the bacteria waste load allocation (WLA) assigned to the County's applicable regulated MS4 area.

1.2 Regulated Areas

The regulated areas with the County's MS4 system were determined according to the VDEQ guidelines during development of the Chesapeake Bay TMDL Action Plan that was submitted to the VDEQ in September of 2015. Those regulated areas have not changed since that submittal and were used in the development of this TMDL Action Plan.

Maps depicting the regulated areas within the Powhatan, Mill and Skiffes Creek drainage basins are depicted on the figure 1 and 2 below. Detailed mapping is presented in Appendix 1

Figure 1 Powhatan and Mill Creek Watersheds with Rgulated Lands and Impared Segments

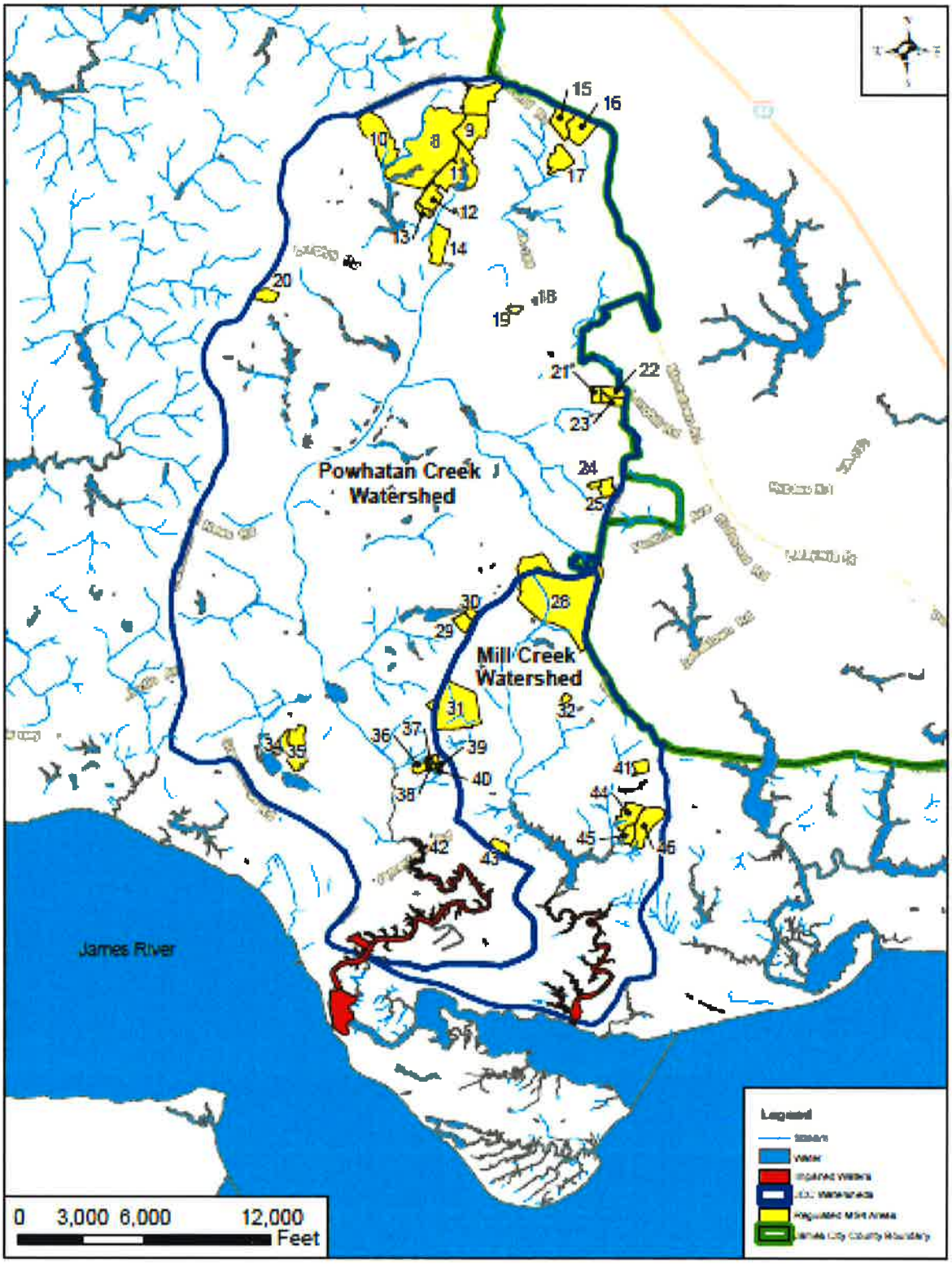


Figure 2 Skiffes Creek Watershed with Rgulated Lands and Impared Segments

There are no MS4 regulated areas that are adjacent to or drain directly to the impaired waterways. A summary of land use information on the regulated areas within the impaired segment drainage areas is provided in Table 1 below:

Table 1. Regulated Area Land Use Information

Regulated Area Information				Regulated Drainage Areas (acre)					
Regulated Area No.	Regualted Area Name	Description	Sub-Watershed	Forest Area	Wetland Area	Open Water Area	Pervious Area	Impervious Area	Total Regulated Area
8	Warhill - Wanner Stadium	School Complex	Powhatan Creek	103.997	6.851	7.968	74.125	34.689	227.631
9	Warhill High School	School Complex	Powhatan Creek	17.256		1.588	7.008	16.311	42.163
10	Adams Hunt	Residential	Powhatan Creek	0.579	2.045		46.032	10.271	58.928
11	Warhill Soccer - East	School Complex	Powhatan Creek	8.447		6.881	43.442	4.951	63.721
12	Warhill Softball - North	School Complex	Powhatan Creek	0.002		0.275	16.753	5.286	22.317
13	Warhill Softball - South	School Complex	Powhatan Creek			0.257	5.527	0.857	6.641
14	Lafayette High School	School Complex	Powhatan Creek	2.245	1.903		12.132	14.926	31.206
15	Clarks Lane - West	Residential	Powhatan Creek				21.147	3.576	24.723
16	Clarks Lane - East	Residential	Powhatan Creek	1.903			26.998	1.649	30.549
17	Forest Heights	Residential	Powhatan Creek	5.825	0.009		16.411	1.959	24.203
18	Fire Station 4	Fire Station	Powhatan Creek				1.041	0.404	1.444
19	Human Services Building	County Facility	Powhatan Creek				2.101	2.456	4.558
20	D. J. Montague Elementary School	School Complex	Powhatan Creek	0.606			8.294	3.962	12.862
21	Recreation Center - West	Recreation Center	Powhatan Creek	4.452			3.267	0.354	8.072
22	Recreation Center - North	Recreation Center	Powhatan Creek				9.057	2.554	11.611
23	Recreation Center - South	Recreation Center	Powhatan Creek				7.008	3.264	10.272
24	Tewning Road - West	County Facility	Powhatan Creek	1.222			0.760	1.820	3.801
25	Tewning Road - East	County Facility	Powhatan Creek	0.545		0.227	2.437	6.563	9.771
29	Mid County Park - South	Park	Powhatan Creek				9.853	1.796	11.649
30	Mid County Park - North	Park	Powhatan Creek				3.401	1.627	5.028
34	Jamestown High School - West	School Complex	Powhatan Creek	3.873		0.503	8.025	1.050	13.450
35	Jamestown High School - East	School Complex	Powhatan Creek	2.968		0.363	16.691	15.399	35.421
36	JCSA Water Treatment Facility	County Facility	Powhatan Creek			0.181	6.154	1.645	7.980
37	Clara Byrd Baker Elementary School - North	School Complex	Powhatan Creek				2.759	1.897	4.656
38	Clara Byrd Baker Elementary School - West	School Complex	Powhatan Creek				1.475	1.322	2.797
39	Clara Byrd Baker Elementary School - East	School Complex	Powhatan Creek				0.690	0.595	1.285
40	Clara Byrd Baker Elementary School - South	School Complex	Powhatan Creek				0.790	0.349	1.139
42	Powhatan Creek Access	Boat Launch	Powhatan Creek	0.054			0.127	0.266	0.448
28	Mill Creek to Rt 199	Residential	Mill Creek	3.147	10.652	0.418	151.019	66.408	231.644
31	Venture Lane Regional BMP	Residential/Commercial	Mill Creek		4.233	0.069	57.357	35.271	96.930
32	Fire Administration & Station 3	Fire Station	Mill Creek	0.012			1.810	2.043	3.865
41	Rawls Byrd Elementary School	School Complex	Mill Creek				5.360	4.085	9.445
43	Lakewood Drive BMP	Church/Residential	Mill Creek				6.463	2.828	9.291
44	Rolling Woods - North	Residential	Mill Creek		0.477	1.025	17.335	5.705	24.542
45	Rolling Woods - South	Residential	Mill Creek			0.381	9.615	2.854	12.850
46	Rolling Woods - East	Residential	Mill Creek	0.002	1.575	0.453	28.817	6.385	37.231
48	Grove Easement	Residential	Skiffes Creek	1.239			10.587	2.639	14.464
POWHATAN CREEK WATERSHED TOTALS				**153.972**	**10.808**	**18.241**	**353.506**	**141.799**	**678.327**
MILL CREEK WATERSHED TOTALS				**3.161**	**16.937**	**2.345**	**277.776**	**125.579**	**425.798**
SKIFFES CREEK WATERSHED TOTALS				**1.239**	**0.000**	**0.000**	**10.587**	**2.639**	**14.464**

1.3 Total Maximum Daily Loads and Waste Load Allocations

A TMDL is the total maximum daily load, or the amount of a pollutant allowable to be discharged to a water body and still have that water body meet its designated use and water quality standards. There are three components to a TMDL as follows:

- Waste Load Allocation (WLA) for point source contributions which are discharges from an identifiable source and location. The County's MS4 outfalls are defined as point source discharges and therefore fall under this category.

- Load Allocations (LA) for non-point source contributions which are from un-identifiable sources or locations and originate over a relatively large area

- Margin of Safety (MOS) which is a required component that accounts for the modeling uncertainty and other unknown factors.

The WLA is a major component of the required reduction in pollutant needed to meet water quality standards. It may be allocated among many different point sources including the MS4 operator. The MS4 General Permit serves as the regulatory mechanism for addressing the load reductions described in the TMDL assigned to the MS4 operator, predominantly through the Action Plan. The expectation of the DEQ is for the MS4 operator to address the required WLAs for stormwater through the implementation of programmatic BMPs and other actions outlined in the MS4 special conditions. Once approved and implemented, these actions will need to be continued in order to maintain water quality standards and comply with the anti-degradation policy requirements.

1.4 MS4 General Permit - Special Conditions

The County operates its regulated MS4 within a portion of the Mill Creek, Powhatan Creek and Skiffes Creek watersheds and is therefore subject to the bacteria TMDL WLAs assigned in the approved TMDLs. The special conditions listed in the MS4 General Permit require the County develop a TMDL Action Plan that identifies the actions to be implemented. These actions are presented in Chapter 4 herein and submittal of these actions satisfies the County's requirements under its MS4 permit. This Action Plan lists the actions that James City County will implement to reduce the bacterial loadings to both non-tidal waters and tidal waters.

It should be noted that the measures implemented solely by the MS4 Action Plan are not likely to significantly reduce bacteria in the targeted watersheds, and not likely to result in attainment of the bacteria standard for primary contact recreation in the three impaired segments. The MS4 regulates a very small portion of the watersheds and the MS4 regulated areas do not discharge directly to any of the impaired waters in the Mill Creek, Powhatan Creek or Skiffes Creeks. Improvements in the regulated areas in these watersheds will result in very minor if any improvements to water quality in the targeted segments. However, the County operates its regulated MS4 within a portion of the watershed and is therefore subject to the bacteria WLAs assigned to it in the approved TMDLs. As a result, the County must maintain an updated MS4 Program Plan that includes a specific TMDL Action Plan.

2.0 Bacteria Water Quality Standards and Applicable TMDLs

The VA DEQ monitoring data for Mill, Powhatan and Skiffes Creeks showed that portions of these Creeks exceeded the fecal coliform bacteria standard and were impaired. Therefore, a TMDL WLA for fecal coliform was assigned. However, the water quality standard for salt-water in Virginia is now based on enterococci which may be a better indicator of health risks.

Both of these particular bacteria types are typically found in the lower intestines of warm-blooded organisms. Certain strains of the bacteria can survive for a limited amount of time outside of a host. Pollution from both point and nonpoint sources can lead to fecal coliform bacteria contamination of water bodies. Although most fecal coliform are not pathogenic, their presence

in water indicates contamination by fecal material. For contact recreational activities such as swimming, health risks increase with increasing fecal coliform counts. If the fecal coliform concentration in a water body exceeds state water quality standards, the water body is listed for violation of the contact recreational use.

According to Virginia Water Quality Standards (9 VAC 25-260-10A), "all state waters are designated for the following uses: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might be reasonably expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish)."

If the waterbody monitoring showed that it had higher levels of coliform in more than 10.5% of the samples and at least two samples exceeded the standards, the waterbody was classified as impaired and the development and implementation of a TMDL is required to bring the waterbody into compliance with the water quality criterion.

The EPA has since recommended that all states adopt an E coli or enterococci standard for fresh water and enterococci criteria for marine waters. The adoption of the E coli and enterococci standard went into effect January 15, 2003 in Virginia. The new criteria, used in developing the bacteria TMDL in this study, are outlined in 9 VAC 25-260-170 and reads as follows:

A. In surface waters, except shellfish waters and certain waters identified in subsection B of this section, the following criteria shall apply to protect primary contact recreational uses:

   1. Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per100 ml of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 ml of water. This criterion shall not apply for a sampling station after the bacterial indicators described in subdivision 2 of this subsection have minimum of 12 data points or after June 30, 2008, whichever comes first.

   2. *E. coli* and *enterococci* bacteria per 100 ml of water shall not exceed the following:

Standard	Geometric Mean	Single Sample Maximum
Freshwater *E. coli* (3)	126	235
Saltwater and Transition Zone *Enterococci* (3)	35	104

[3] See 9 VAC 25-260-140 C for freshwater and transition zone delineation.

A WLA for each stream was calculated for existing point sources, including MS4 permit operators, along with LAs and the MOS to meet the water quality standard and the TMDLs were established based on a scenario where no violations of the water quality standards would occur. The established TMDL included reductions from various land uses such as agriculture, wildlife, and residential uses.

Bacteria WLA's for three Creeks in James City County have been assigned and approved in the following documents

- "Bacteria Total Maximum Daily Load Development for Mill Creek and Powhatan Creek approved in July, 2009, and

- "Fecal Bacteria Total Maximum Daily Load Development for the Warwick River Submitted December 13, 2007

Mill Creek (Segment VAT-G10E-03) was initially listed as impaired on Virginia's 2002 303(d) Report on Impaired Waters due to exceedances of Virginia's water quality standard for fecal coliform. In January 2003, Virginia adopted a water quality standard for *enterococci* bacteria for saltwater and transition zones. Mill Creek was listed as not supporting the Recreation Use on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report (VADEQ, 2006) due to water quality violations of the *enterococci* bacteria standard.

Powhatan Creek had two segments that were identified as impaired and did not support the Recreation Use. Segment VAT-G10E-01, the tidal segment of Powhatan Creek, was listed in Virginia's 1998 303(d) TMDL Priority List and Report because of violations of the fecal coliform water quality standard. Since the approval of those TMDLs, the non-tidal section of Powhatan Creek (segment VATG10R-POW01A00) has been delisted as a result of additional monitoring by DEQ in 2008. The tidal segment of Powhatan Creek is still currently listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the enterococci bacteria standard.

The Skiffes Creek impaired segment previously consisted of the tidal portion of Skiffes Creek which was first listed on the 1998 303(d) Total Maximum Daily Load Priority List and Report. This section is known as the James River – Opposite Fort Eustis & Skiffes Creek segment (waterbody ID# VAT-G11E). This segment was Condemned Shellfish Area Number #059-023 and was also impaired and not supporting the VDH shellfish harvesting use as of December 5, 2005. Skiffes Creek was subsequently delisted in 2010 for shellfish and the draft 2014 Integrated Report has no 303d bacteria impairments for Skiffes Creek. However, since the TMDL is still in place with a WLA for JCCs MS4 permit, an action plan must be completed. When waterbodies are delisted, the MS4 must continue to implement actions to prevent further degradation to maintain the water quality and designated uses.

Only the tidal segments of Powhatan Creek, Mill Creek are currently listed as impaired on Virginia's 2014 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the enterococci bacteria standard.

3.0 Implementation Plan Summary and Update

3.1 Overview

A TMDL study for the Mill Creek and Powhatan Creek watersheds, completed by DEQ in March 2008, examined the watershed characteristics and the sources of fecal coliform to the creeks. Using

monitoring data, bacterial source tracking (BST), and watershed models, DEQ assigned maximum allowable loads to each source in the watersheds in order to bring Mill and Powhatan Creeks into compliance with the water quality standard for primary contact recreation. A TMDL study for the Warwick River (including Skiffes Creek) was completed by VDEQ on December 13, 2007 that modeled several scenarios to achieve designated uses in Skiffes Creek.

The following table outlines the source reductions necessary (as estimated by the TMDL modeling) to achieve water quality standards. These reductions also provide the direction as to which actions will achieve the most effective results. The established TMDL included reductions from various land uses such as agriculture, wildlife, and residential uses.

Impaired Waterbody	Agriculture	Wildlife	Residential	Forest	Marinas	Human Direct
Mill Creek	92%	92%	92%	0%	0%	-----
Powhatan Creek	92%	92%	92%	0%	100%	------
Skiffes Creek	96%	91%	99%	----	------	100%

In 2011 an Implementation Plan (IP) for Fecal Coliform TMDL for Mill Creek and Powhatan Creek was prepared by the Hampton Roads Planning District Commission (HRPDC) in cooperation with the Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Health and James City County. This IP recommended a set of actions to be taken by various stakeholders to reduce the levels of fecal coliform bacteria in the targeted watersheds including JCC as the operator of its MS4 System. The actions outlined primarily target bacteria from human and pet ("anthropogenic") sources. The full IP report is provided in Appendix B

The management actions outlined in the IP capitalize on existing and planned programs and efforts within the Mill and Powhatan Creek watersheds. These actions are also considered for the Skiffes Creek watershed: Ongoing actions have already been initiated in response to other regulatory programs, and are expected to reduce bacteria loads to the targeted waterbodies.

All management actions were divided into the following eight management categories to address the primary sources of bacteria contribution.

- Sanitary Sewer System Improvements
- Septic System Programs
- Stormwater Quality Programs
- Boating Programs
- Pet Waste Programs
- Aquatic Resources Restoration
- Land Use Management
- Wildlife Contribution Controls

3.2 Stakeholders and TMDL Program Update

Stakeholders were identified at the beginning of IP development and along with agency representatives and County staff involved throughout its development. Many of the management actions described in the IP have been underway since the development of the IP in 2011 and some completed by federal, state, regional and local agencies and non-governmental organizations along with JCC in a collaborative effort to achieve the primary goal of reducing fecal coliform concentrations within the Mill Creek, Powhatan Creek, and Skiffes Creek Watersheds. Other actions are scheduled to be implemented in the future. JCC and other stakeholders continue to implement the IP. Appendix B includes a full listing of all stakeholder accomplishments since development of the TMDL IP.

3.3 JCSA and JCC IP Management Actions Update

3.3.1 JCSA Update

Sanitary Sewer Improvements

The James City Service Authority (JCSA) provides municipal water and wastewater service to County residents and businesses in the primary service area including James City County, limited sections of York County and the City of Williamsburg. The County has recently entered into an agreement with HRSD called the Hybrid Consolidation Plan with the localities it serves including JCC under which JCSA is responsible for its systems operation and maintenance and HRSD will undertake actions to reduce SSOs through the system repairs and rehabilitation outlined in its RWWMP that will be completed by 2017.

Actions completed since the development of the IP include the development and implementation of a Sanitary Sewer System Evaluation Survey (SSES) and the development of the Condition Assessment and Rehabilitation Plan.

The SSES had three phases which have been completed. The first phase involved the physical inspection of 100% of the sewer manholes in each SSES basin. The second phase involved the smoke testing of the system to identify leaks and interconnections with the stormwater system and the final phase involved the closed circuit TV inspection of the sewer lines. The third phase,, the Condition Assessment and Rehabilitation Plan was then developed, which identified improvements to the system necessary to correct deficiencies. This Plan will be implemented over the next 20 years through the RWWMP.

Projects undertaken by JCSA prior have been substantial and have significantly reduced infiltration and SSO's to the impaired waterways. Some of the more notable projects have included:

- LS 1-5 Area 1 Flextran Rehabilitation project of 11,000 feet of sewer and manhole rehabilitation to reduce inflow and infiltration. (October 2014)
- Tarleton Bivouac sewer replacement project consisting of 300 feet of 8-inch sewer and 2 manholes (March 2015)

- Manhole repairs – 40 Manholes (2015)
- HRSD project along Route 199 near Kingspoint to reduce pressures and reduce SSO's at approximately 20 JCSA sites (December 2014)
- Powhatan Creek Basin, Chisel Run- Gravity Sewer Improvement Project including lining 11,450 LF of 15-18 inch gravity sewer to reduce infiltration.
- Powhatan Creek Basin - Electro Scan inspection of 20,000 LF of gravity sewer in
- Inspected Manholes and gravity sewer in Mill Creek Basin; repaired several pipes to reduce infiltration (June 2014)
- Skiffes Creek Basin - Pipe and manhole inspections and pipeline repairs to reduce infiltration (June 2014)
- Inspected 6,000 manholes in the SSES identified basins (2013)
- Smoke Tested 100% of sewer mains in SSES basins (2013)
- TV monitoring inspection of 100% of older sewer pipe (installed before 1980)
- Conducted night flow monitoring and wet weather investigations in selected SSES basins (2013)
- Powhatan Creek sewer improvement project/lining along from LS1-2 to News Road including 11,000 LF of 18-24 inch gravity sewer pipe (June 2012)
- Mill Creek LS3-1 – Improved pumps to reduce wet weather SSO's (June 2012)
- Completed 49 manhole and pipe repairs in Powhatan basins to reduce infiltration and over flows (June 2011)
- Mill Creek Basin- Completed 53 manhole and pipe repairs to reduce infiltration and overflows. (June 2011)
- Skiffes Creek Basin- Completed 6 manhole and pipe repairs to reduce inflows and infiltration.(June 2011)

3.3.2 James City County (JCC)

James City County has a significant role in improving water quality within the boundaries of the County. The County will continue its programs to treat stormwater runoff, prevent SSOs, and manage land use development to the maximum extent practicable as directed by its Board of Supervisors and as required by law. Actions undertaken to implement the IP since its development include:

Septic System Programs

Most of the household sanitary sewage is discharged to the public sewer system. County records indicate that 360 properties continue to use a septic system County -wide. Septic Systems in the County continue to be reduced as new connections to the public sewer are made. As part of the County's adopted Chesapeake Bay Ordinance, property owners with septic systems are required to have them pumped out at least every 5 years and notify the County providing evidence that they system was pumped out.

Stormwater Quality Programs

There are 678 acres of County MS4 regulated area the Powhatan Creek watershed, 426 acres in the upper part of the Mill Creek and 14 acres of Skiffes Creek watershed that are covered by the County's MS4 permit. Since 2011 as part of its continued MS4 permit actives, many of the action

items identified in the IP have been incorporated into the County's permit and are currently being implemented. The County has included the following programs as part of its MS4 permit to reduce the bacteria concentrations delivered to the impaired watersheds through its stormwater runoff.

IDDE
Public Outreach and Participation
Construction Site Stormwater Runoff Control
Post Construction Stormwater Runoff
Pollution Prevention/Good Housekeeping for Municipal Operations

In addition there are several stormwater quality programs identified beyond the MS4 permit programs that the County has participated in to reduce bacterial loadings including:

- *Rain Garden Program* - James City County provides funding for local residents to build rain gardens to treat roof and driveway runoff. There are now 36 rain gardens now which will collectively treat more than 7.5 acres helping to reduce runoff and any associated nutrients, wildlife and pet wastes from the treated properties helping to reduce bacteria loadings to the streams.

- *Citizen Monitoring Program* - In order to gather additional information about the distribution of bacteria sources in the watersheds, the James City County Stormwater Division, with assistance from the VDEQ, began monitoring at seven sites on Powhatan Creek and five in Mill Creek.

- *Bacteria Source Tracking* – JCC participated in the HRPDC regional effort to develop a bacterial identification methodology to use to differentiate bacteria sources so that TMDL plans can be designed and targeted to address the cause of the bacterial impairment.

Boating Programs

James City County purchased the Jamestown Yacht Basin in 2006 and began a series of improvements aimed at both user safety and environmental protection. To date the County has:

- eliminated the aging on-site waste disposal system and connected the system to public sewer through a grinder pump and force main
- stabilized the docks to minimize shoreline erosion
- installed new electrical connections for the facility and docks
- upgraded the water supply lines to minimize leaks, conserve water and eliminate ongoing erosion along water lines
- Installed a sanitary waste pump-out system

Pet Waste Programs

Recognizing that bacterial impairments were a county-wide problem, James City County initiated a local Scoop-the Poop campaign and have placed 18 pet waste stations in the County park trail system and 25 in local neighborhoods. The JCC Stormwater Division has continued to focus on pet owners, participating in the annual Humane Society's Bark-in-the Park fundraiser, the HRPDC Scoop-the-Poop campaign materials are extensively utilized and the HRPDC Poop Fairy PSAs air on the County's government and community access channels.

Aquatic Resource Restoration

The County has implemented a watershed restoration approach that includes stream restoration which has also been incorporated into its Chesapeake Bay TMDL Action Plan strategy. The following stream restoration projects have been implemented as part of that plan.

Scotts Pond Stream Restoration
Whistle Walk Stream Restoration

Land Use Management

Land disturbing activities within James City County are regulated under its " Virginia Stormwater Management Program" which has been updated to incorporate the requirements of the Virginia Erosion and Sediment Control (ESC) Program as well as the Chesapeake Bay Preservation Act (CBPA), the Virginia Stormwater Management Program (VSMP), and the States General Permit for Discharges of Stormwater from Small Municipal Separate Storm Sewer Systems (MS4) and other controls to protect the water quality of the County's lakes and streams. Development practices require buffers from wetlands, shorelines, and highly erodible soils which help reduce bacteria loadings.

Wildlife Contribution Controls

James City County encourages pond buffers or setbacks to both help filter stormwater and to discourage resident wildlife populations. The County BMP manual provides guidelines on the effective placement and size (width) of buffers. Native shrubs and ground covers are recommended in the non-forested areas of the buffer to discourage wildlife. Annual mowing is not required in the pond buffer except in maintenance right-of-ways. In 2011, James City County installed "Do Not Mow Zone" signs along the County-owned BMP pond buffers to lead by example.

3.4 Stakeholder Management Action Success

As a result of stakeholder actions since the 2008 Integrated Report and 2011 IP, the non-tidal segment of Powhatan Creek (VAT-G10R-02) was not-listed as impaired for bacteria during the current assessment cycle. Additional monitoring demonstrated that the non-tidal segment was fully supporting the bacteria water quality standards, and water quality continues to improve. Skiffes Creek was subsequently delisted for shellfish and the draft 2014 Integrated Report has no 303d bacteria impairments for Skiffes Creek. Continued action plan implementation is needed however on all sections, formerly or currently listed, in order to assure that the water quality in the delisted segments is maintained.

4.0 Skiffes, Powhatan and Mill Creek's TMDL Action Plan

James City County operates its MS4 on regulated lands within the watersheds of these impaired streams and is therefore subject to the bacteria WLAs it was assigned in the approved TMDLs. As a result, the County must maintain an updated MS4 Program Plan that includes specific Action Plans for bacteria.

The overall actions by the JCC as well as the other stakeholders are programmatic in nature and do not target specific numeric reductions in Fecal Coliform, E coli, or enterococci bacteria that have not been calculated to achieve a designated receiving water quality standard. Rather, the actions proposed are selected to achieve the maximum reductions practicable to reduce bacterial loadings from the identified sources as outlined in the IP. The resulting improvements to water quality if any will be demonstrated through continued monitoring by DEQ.

This TMDL Action Plan must identify the best management practices and other interim milestone activities to be implemented during the remaining terms of this state permit including:

- Developing and maintaining a list of legal authorities applicable to reducing discharge of E.coli from the MS4

- Maintaining a list of additional management practices and controls, beyond those required within the six minimum control measures of the MS4 General Permit, that are implemented as part of James City County's MS4 Program and applicable to reductions in E.coli discharge from the MS4;

- Enhancing the County's Public Education and Outreach Plan and employee training program to promote methods to eliminate and reduce discharges of E.coli into the County's MS4;

- An identification and assessment of facilities that are owned and operated by the County, with the potential (greater than the average expected loading) to be significant sources of E.coli discharge;

- A methodology to assess the effectiveness of the County's Action Plan in reducing the discharge of E.coli from the County's MS4.

4.1 Legal Authority

The County's VSMP permit requires it as the MS4 conveyance system owner and operator to maintain an updated MS4 program plan that includes a specific TMDL Action Plan for pollutants allocated to the MS4. The actions developed address the sources of bacteria generated and discharged from its regulated areas.

The County is required to – *"Develop and maintain a list of its legal authorities such as ordinances, state and other permits, orders, specific contract language, and inter-jurisdictional agreements applicable to reducing the pollutant identified in each applicable WLA."* [Section I(B)(2)(a)]

James City County has reviewed its current MS4 program and has determined that it has in place all of the legal authorities that it needs to implement any of the TMDL Actions Identified in this plan. It has also reviewed its current inventory of regulated areas and has determined that it is up

to date. These local regulations are incorporated into Article II, Chapter 8- 20 et seq. of the County's soil erosion and sediment control ordinance known as "The Virginia Stormwater Management Program" (Ord. No. 85A-21, 5-13-14) to implement those requirements. As stated in that ordinance:

> **Sec. 8-20. Title, purpose and authority.**
> (a) This ordinance shall be known and may be cited as "The Virginia Stormwater Management Program Ordinance."
> (b) Pursuant to § 62.1-44.15:27 of the Code of Virginia, this ordinance is adopted to address the mandate to integrate the County stormwater management requirements with the county erosion and sediment control (Chapter 8), flood insurance and floodplain management (Chapter 24, Article VI Overlay Districts, Division 3), Chesapeake Bay Preservation (Chapter 23) and Stormwater Management, Illicit Discharge Detection and Elimination (Chapter 18A) requirements into a unified stormwater program. The unified stormwater program is intended to facilitate the submission and approval of plans, issuance of permits, payment of fees, and coordination of inspection and enforcement activities into a more convenient and efficient manner for both the County and those responsible for compliance with these programs.
> (c) The purpose of this article is to protect the general health, safety, welfare, and property of the citizens of the county and protect the quality and quantity of state waters from the potential harm of unmanaged stormwater including protection from a land disturbing activity causing unreasonable degradation of properties, water quality, stream channels, waterways and other natural resources, and to establish procedures whereby stormwater management and stormwater pollution prevention requirements related to water quality and quantity shall be administered and enforced.
> (d) This article is adopted pursuant to Article 2.3 (§ 62.1-44.15:24 et seq.) of Chapter 3.1 of the Code of Virginia and 9VAC25-870 et seq. of the Virginia Administrative Code.

4.2 Additional Management Practices and Actions

As an element of the TMDL Action plan, the County must maintain a list of all measures that it takes in addition to the minimum control measures that it currently implements as part of its "Minimum Control Measures as follows:

"Identify and maintain an updated list of all additional management practices, control techniques and system design and engineering methods, beyond those identified in Section II B (Minimum Control Measures) that have been implemented as part of the MS4 Program Plan that are applicable to reducing the pollutant identified in the WLA." Section I(B)(2)(b)

4.2.1 Pet Waste Control Program

Waste loading associated with pets is largely confined to residential areas, but it may also be assumed that waste can enter waterways along adjoining streets and in areas frequented by dog

owners, such as parks, trails, and recreation areas where dogs are permitted. Since 2008 JCC has focused on outreach to pet owners through a local Scoop-the Poop campaign by placing pet waste stations along the County park trail system at critical high use areas in County parks. Of the 43 units placed, nine are located within the Powhatan Creek watershed. The County has offered similar systems to neighborhoods which agree to undertake the maintenance and it has placed six units in Powhatan Creek neighborhoods and one unit in a Mill Creek neighborhood. The stations include a bag dispenser, signage, and a waste container, and Parks and Recreation staff provide regular maintenance. Furthermore, the County works closely with the regional askHRGreen.org program to spread the awareness of pet waste issues. JCC Stormwater will continue these programs and will increase the number of pet waste stations over the next 2 years.

4.2.2 Coliscan Monitoring Program

In order to gather additional information about the distribution of bacteria sources in the watersheds, the James City County Stormwater Division, with assistance from the VDEQ, began monitoring for indicator bacteria in April 2009 using the Coliscan Easygel method from Micrology Laboratories. Monitoring is underway at seven sites on Powhatan Creek and five in Mill Creek and data is collected on a monthly basis. The County will continue to provide support to the citizen volunteer water quality monitors.

4.2.3 BMP Bacteria Retrofit Program

The IP recommended including an action item to further determine the feasibility of implementing designs to maximize bacteria removal in the impaired watersheds. The County will conduct a feasibility study to determine how many facilities it operates in the impaired watersheds that might be feasible to retrofit with bacteria removal improvements.

4.2.4 Chesapeake Bay TMDL Action Plan

The County will continue implementing and maintaining projects identified as part of its Chesapeake Bay TMDL Action Plan. Its primary purpose is the reduction of nutrients and sediments to the Chesapeake Bay however these programs and actions contained in that plan will also serve to reduce the anthropogenic sources of bacteria within the Mill Creek, Powhatan and Skiffes Creek Watersheds. Because the Mill, Powhatan and Skiffes Creek watersheds are direct tributaries to the Chesapeake Bay, implementing BMPs to help achieve the TMDL Bay goals by reducing sediment and nutrients loads will also help to reduce bacteria levels in these creeks.

4.3 Enhanced Public Outreach

James City County currently implements a public education and outreach program as part of Minimum Control Measure number 1 through a regional stormwater management program administered by the Hampton Roads Planning District Commission (HRPDC) member communities. The HRPDC askHRGreen.com program has focused on bacteria issues since inception. The program uses a mix of media outlets and methods to reach pet owners in the region. Premium items such as pet waste collection stations and other tools emphasize the "bag-it, trash

it" message. At the same time, the County lists information regarding TMDL pollutants of concern, including E.coli, on its web site and the County's Public Education and Outreach Plan. As part of the General Permit Section I.B.2.c it must addresses the following permit special condition:

"Enhance public education and outreach and employee training programs to also promote methods to eliminate and reduce discharges of the pollutants identified in the WLA".

The following special programs will be implemented by the County to address this requirement.

4.3.1 Enhanced Employee Training Program

The County's pollution prevention and good housekeeping training program is codified in the County Administrative Regulation 28. Awareness of bacterial contamination specifics will be incorporated into the training requirements for employees working or managing County facilities, including Fire, Police, Parks, General Services and Schools employees. In addition, SWPPPs and standard operating procedures (SOPs) will be reviewed and, where appropriate, additional information on bacterial contamination be included in the employee/staff training program as part of those training plans.

4.3.2 Enhanced Public Outreach on Pet Waste

James City County has an active public outreach campaign to reduce bacteria loadings from pet waste. It will continue to focus on pet owners, providing premium items with a scoop-the poop message. The County will continue to coordinate with the HRPDC outreach program and the HRPDC Scoop-the-Poop campaign materials are extensively utilized. The HRPDC Poop Fairy PSAs air on the County's government and community access channels.

Additionally, the County has prepared a public service announcement (PSA) explaining the use of the pet waste station campaign and availability of the pet waste stations and published information on its webpages which it will continue.

4.3.3 Enhanced Public Outreach at Access Sites

James City County recognizes the importance of controlling bacteria loadings at the Marina which is adjacent to impaired waters and is developing an expanded education program to provide outreach materials to boaters on ways to reduce their impact on water quality.

Although the marina is not in a regulated area, the JCC Stormwater Division will enhance its public outreach to include public awareness on their bacteria impairment and the importance of "No Discharge" to these waters. In addition it will include information on the location and use of the sanitary waste pump-out facility that was installed in 2010 and is available to boaters. Measures will include signage at the Marina and information posted on the County's public access channel during the summer boating season. In addition the County will continue to support the askHRGreen public outreach program through its participation in HRPDC.

4.4 Assessment of County Facilities

The MS4 permit requires the County to *"Assess all significant sources of pollutant(s) from facilities of concern owned or operated by the MS4 operator that are not covered under a separate VPDES permit and identify all municipal facilities that may be a significant source of the identified pollutant. WLA."* Section I(B)(2)(d)

The County facilities within the regulated areas will be assessed to determine their potential for discharging E. coli to the County's MS4 or directly into surface waters. Potential sources include those associated with the municipal facilities that potentially produce bacteria pollution as a part of their operations, or those subject to loading from outside sources, such as pets at recreational parks, schools and municipal open space. Facilities evaluated may include: Williamsburg-James City Schools, Parks, Maintenance facilities, Convenience Centers, and Municipal open space where pets are walked. Special attention will be given to evaluating on-site septic systems at County facilities to determine their potential as a significant source of bacterial pollution.

4.5 TMDL Action Plan Assessment and Timeline

James City County will implement the MS4 Program components described above to reduce the potential of E.coli discharge to surface waters. It is required to *"Develop and implement a method to assess TMDL Action Plans for their effectiveness in reducing the pollutants identified in the WLAs*." [Section I(B)(2)(e)]. The method of assessment and interim milestones include:

- The completion of management actions will be tracked and reported in James City County's MS4 annual reports. These measures will be annually assessed to determine if they should be modified at the end of the year and revisions if necessary incorporated into the permit through the annual report.

- Progress towards meeting water quality goals will be tracked by through the completion of the 305(b)/303(d) Water Quality Assessment Integrated Report submitted by the Virginia DEQ to EPA every even numbered year. That report is a summary of the water quality conditions for the five year assessment period preceding the report, and serves as the State's list of impaired waters.

The success of the management actions proposed in this document will be determined by ambient water quality data rather than a demonstration of attaining an assigned waste load allocation. These management actions were chosen because it is believed they will have the greatest effect on improving water quality in these watersheds. As actions are implemented, water quality data are collected, and new information and technology become available, actions that are deemed ineffective will be discontinued and new actions may be added.

The actions proposed in this Plan will be implemented in the years identified in the proposed program summary

4.6 Actions in Future Permit Cycles

As required by its MS4 permit, JCC will "*Identify the best management practices and other steps that will be implemented during the next state permit term as part of its reapplication process*". This re-application will be submitted following re-issuance of the State's General Permit.

The future reduction strategies will continue to addresses sources with potentially the largest impact on water quality such as sanitary sewer overflows, septic system failures, pet waste, stormwater runoff and recreational boating. The initial implementation actions in this permit cycle were developed to reduce human and pet sources of bacteria loadings whereas future strategies may need to also focus on wildlife as the single largest remaining contributing source.

If all these actions prove to be insufficient to meet the water quality criterion for primary contact recreation in all or parts of the Skiffes, Mill and Powhatan Creeks, then the designation of these waters may need to be further evaluated through a special study called a Use Attainability Analysis (UAA to determine if the designated use should be changed in an amendment to the water quality standards regulations.

Appendix 1

James City County

Regulated Areas

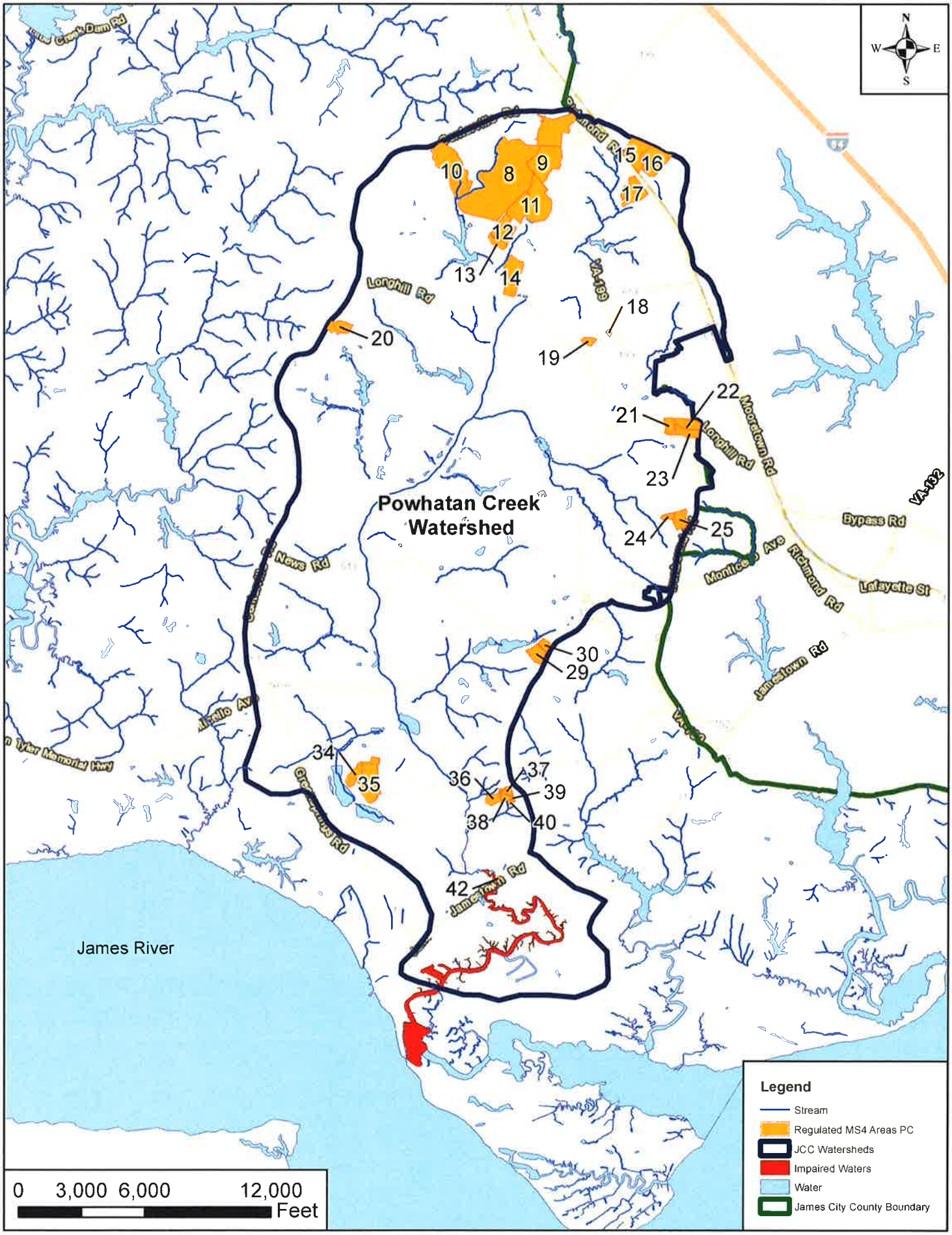
Introduction

The regulated areas with the County's MS4 system were determined according to the VDEQ guidelines during development of the Chesapeake Bay TMDL Action Plan that was submitted to the VDEQ in September of 2015. Those regulated areas have not changed since that submittal and were used in the development of this TMDL Action Plan. See Table A1.1 below for a comprehensive list of all regulated areas within Powhatan, Mill and Skiffes Creek drainage basins.

Regulated Area Information				Regulated Drainage Areas (acre)					
Regulated Area No.	Regualted Area Name	Description	Sub-Watershed	Forest Area	Wetland Area	Open Water Area	Pervious Area	Impervious Area	Total Regulated Area
8	Warhill - Wanner Stadium	School Complex	Powhatan Creek	103.997	6.851	7.968	74.125	34.689	227.631
9	Warhill High School	School Complex	Powhatan Creek	17.256	-	1.588	7.008	16.311	42.163
10	Adams Hunt	Residential	Powhatan Creek	0.579	2.045	-	46.032	10.271	58.928
11	Warhill Soccer - East	School Complex	Powhatan Creek	8.447	-	6.881	43.442	4.951	63.721
12	Warhill Softball - North	School Complex	Powhatan Creek	0.002	-	0.275	16.753	5.286	22.317
13	Warhill Softball - South	School Complex	Powhatan Creek	-	-	0.257	5.527	0.857	6.641
14	Lafayette High School	School Complex	Powhatan Creek	2.245	1.903	-	12.132	14.926	31.206
15	Clarks Lane - West	Residential	Powhatan Creek	-	-	-	21.147	3.576	24.723
16	Clarks Lane - East	Residential	Powhatan Creek	1.903	-	-	26.998	1.649	30.549
17	Forest Heights	Residential	Powhatan Creek	5.825	0.009	-	16.411	1.959	24.203
18	Fire Station 4	Fire Station	Powhatan Creek	-	-	-	1.041	0.404	1.444
19	Human Services Building	County Facility	Powhatan Creek	-	-	-	2.101	2.456	4.558
20	D. J. Montague Elementary School	School Complex	Powhatan Creek	0.606	-	-	8.294	3.962	12.862
21	Recreation Center - West	Recreation Center	Powhatan Creek	4.452	-	-	3.267	0.354	8.072
22	Recreation Center - North	Recreation Center	Powhatan Creek	-	-	-	9.057	2.554	11.611
23	Recreation Center - South	Recreation Center	Powhatan Creek	-	-	-	7.008	3.264	10.272
24	Tewning Road - West	County Facility	Powhatan Creek	1.222	-	-	0.760	1.820	3.801
25	Tewning Road - East	County Facility	Powhatan Creek	0.545	-	0.227	2.437	6.563	9.771
29	Mid County Park - South	Park	Powhatan Creek	-	-	-	9.853	1.796	11.649
30	Mid County Park - North	Park	Powhatan Creek	-	-	-	3.401	1.627	5.028
34	Jamestown High School - West	School Complex	Powhatan Creek	3.873	-	0.503	8.025	1.050	13.450
35	Jamestown High School - East	School Complex	Powhatan Creek	2.968	-	0.363	16.691	15.399	35.421
36	JCSA Water Treatment Facility	County Facility	Powhatan Creek	-	-	0.181	6.154	1.645	7.980
37	Clara Byrd Baker Elementary School - North	School Complex	Powhatan Creek	-	-	-	2.759	1.897	4.656
38	Clara Byrd Baker Elementary School - West	School Complex	Powhatan Creek	-	-	-	1.475	1.322	2.797
39	Clara Byrd Baker Elementary School - East	School Complex	Powhatan Creek	-	-	-	0.690	0.595	1.285
40	Clara Byrd Baker Elementary School - South	School Complex	Powhatan Creek	-	-	-	0.790	0.349	1.139
42	Powhatan Creek Access	Boat Launch	Powhatan Creek	0.054	-	-	0.127	0.266	0.448
28	Mill Creek to Rt 199	Residential	Mill Creek	3.147	10.652	0.418	151.019	66.408	231.644
31	Venture Lane Regional BMP	Residential/Commercial	Mill Creek	-	4.233	0.069	57.357	35.271	96.930
32	Fire Administration & Station 3	Fire Station	Mill Creek	0.012	-	-	1.810	2.043	3.865
41	Rawls Byrd Elementary School	School Complex	Mill Creek	-	-	-	5.360	4.085	9.445
43	Lakewood Drive BMP	Church/Residential	Mill Creek	-	-	-	6.463	2.828	9.291
44	Rolling Woods - North	Residential	Mill Creek	-	0.477	1.025	17.335	5.705	24.542
45	Rolling Woods - South	Residential	Mill Creek	-	-	0.381	9.615	2.854	12.850
46	Rolling Woods - East	Residential	Mill Creek	0.002	1.575	0.453	28.817	6.385	37.231
48	Grove Easement	Residential	Skiffes Creek	1.239	-	-	10.587	2.639	14.464
			POWHATAN CREEK WATERSHED TOTALS	**153.972**	**10.808**	**18.241**	**353.506**	**141.799**	**678.327**
			MILL CREEK WATERSHED TOTALS	**3.161**	**16.937**	**2.345**	**277.776**	**125.579**	**425.798**
			SKIFFES CREEK WATERSHED TOTALS	**1.239**	**-**	**-**	**10.587**	**2.639**	**14.464**

Table A1.1 - Regulated Areas

Maps depicting the regulated areas within the Powhatan, Mill and Skiffes Creek drainage basins are depicted below on Figures A1.1, A1.2 & A1.3, respectively:

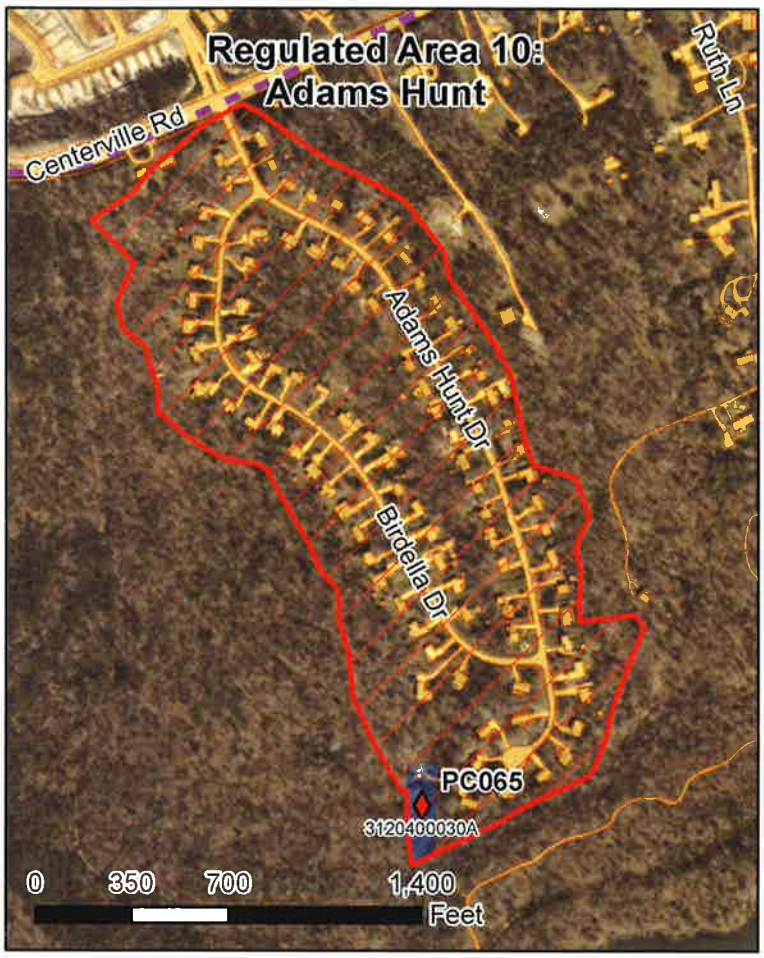


Appendix 1 - James City County Regulated Areas

Powhatan Creek Watershed Overview Map


Regulated Area 8:
Warhill - Wanner Stadium
Richmond Rd
Centerville Rd
Route 199
Adams Hunt Dr
3210100012
PC105
Warhill Trail
Route 199
0
375
750
1,500
Feet


Regulated Area 9:
Warhill High School
3210100018
PC204
Route 199
0 200 400 800
Feet


Regulated Area 10:
Adams Hunt
Centerville Rd
Ruth Ln
Adams Hunt Dr
Birdella Dr
PC065
3120400030A
0 350 700 1,400
Feet

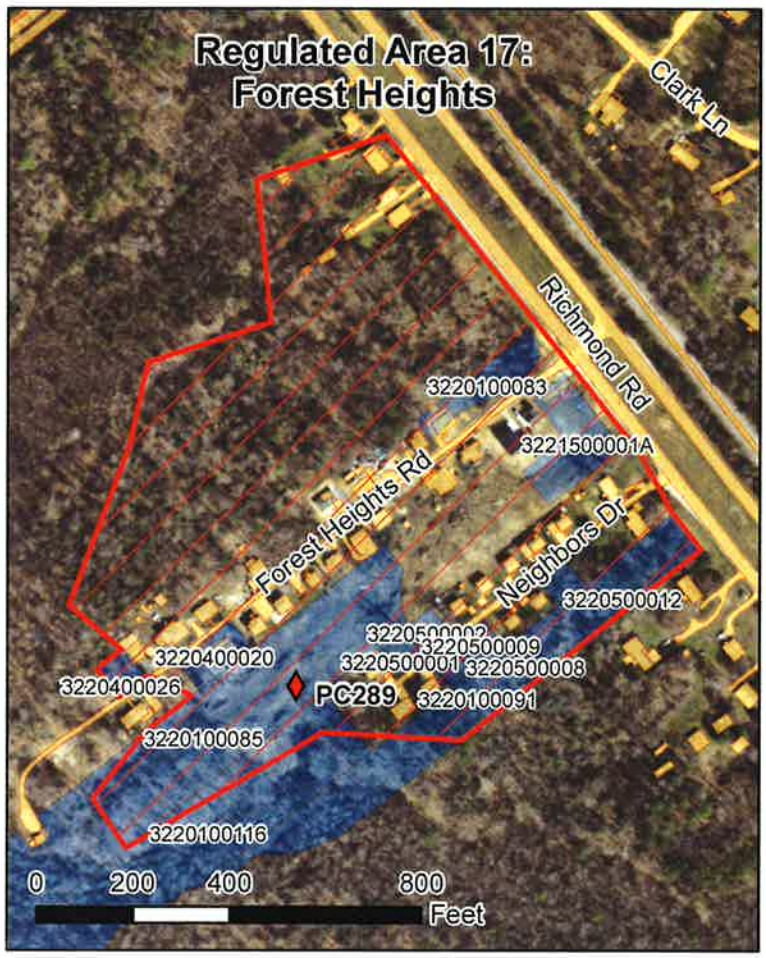

Regulated Area 11:
Warhill Soccer - East
Warhill Trail
3210100012
PC106
PC205
0 300 600 1,200
Feet


Regulated Area 12:
Warhill Softball - North
Warhill Trail
3210100012
PC108
PC107
Regulated Area 13:
Warhill Softball - South
0 225 450 900
Feet


Regulated Area 14:
Lafayette High School
Autumn W
3210100001B
3230100001
Seasons Trace
PC101
Longhill Rd
0
275
550
1,100
Feet


Regulated Area 15:
Clarks Lane - West
Old Mooretown Rd
3220100114
Curry Dr
PC127
Wellesley Blvd
Richmond Rd
3220100113
Clark Ln
0
225
450
900
Feet


Regulated Area 16:
Clarks Lane - East
Curry Dr
Old Mooretown Rd
Catalpa Dr
3310100003
3310100005
Clark Ln
3220100052
3220100112
PC126
Rain Tree Way
0
200
400
800
Feet


Regulated Area 17:
Forest Heights
Clark Ln
Richmond Rd
3220100083
3221500001A
Forest Heights Rd
Neighbors Dr
3220500012
3220400020
3220400026
PC289
3220100091
3220100085
3220100116
0
200
400
800
Feet


Regulated Area 18:
Fire Station 4
Olde Towne Rd
3240100027
0
50
100
200
Feet


Regulated Area 19:
Human Services Building
New Point Rd
3240100029A
PC010
Olde Towne Rd
Longhill Rd
0
125
250
500
Feet


Regulated Area 20:
D.J. Montague Elementary School
Centerville Rd
Mulberry Ln
PC263
3130100049
St Andrews Dr
0
175
350
700
Feet


Regulated Area 21:
Recreation Center - West
Regulated Area 22:
Recreation Center - North
Longhill Rd
PC039
3820100002
3820100002A
3910100153
PC074
3910100154
Ashbury Ln
Longhill Connector Rd
Regulated Area 23:
Recreation Center - South
0
250
500
1,000
Feet


Regulated Area 24:
Tewning Road - West
Tewning Rd
3910100003
PC168
0
100
200
400
Feet

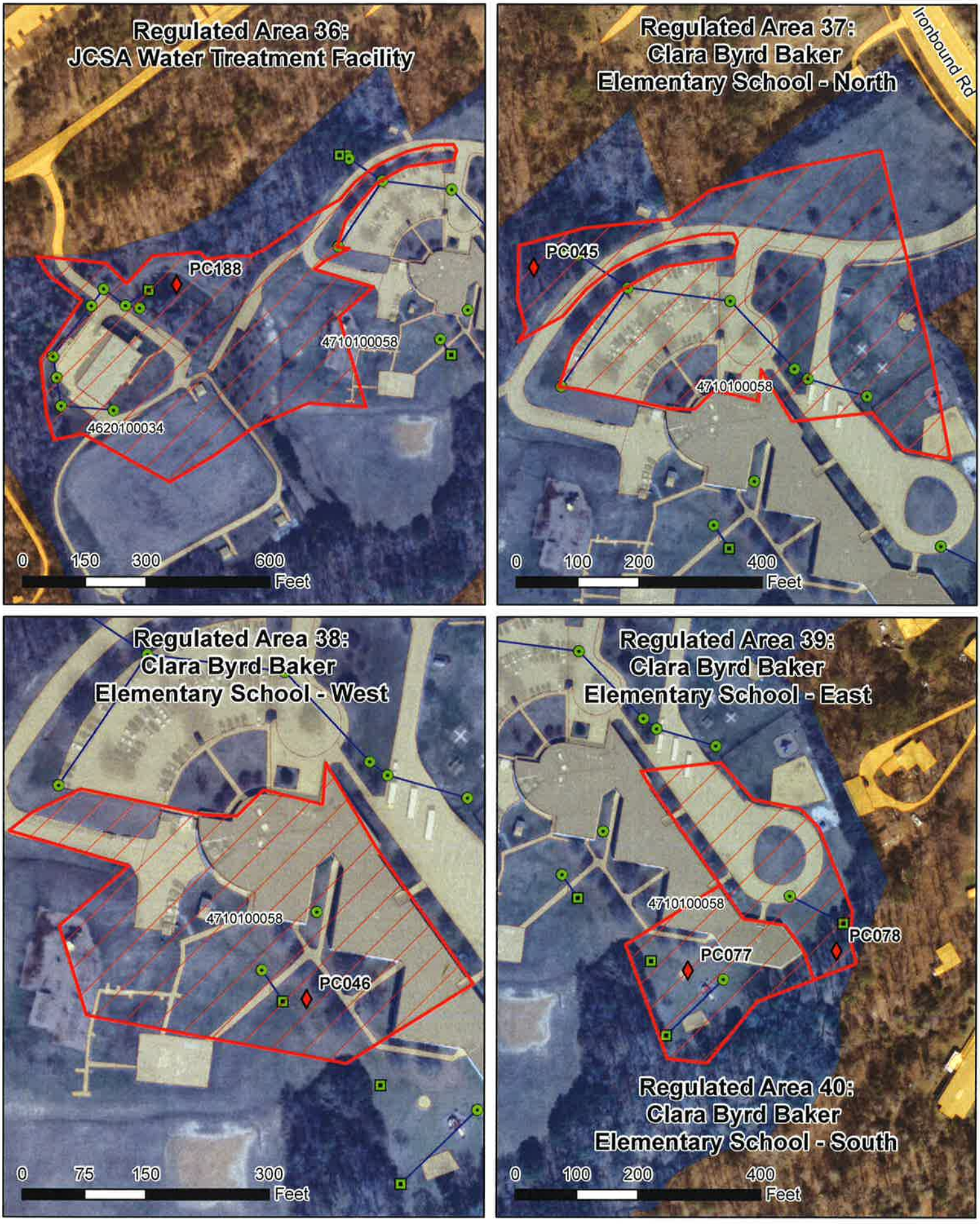

Regulated Area 25:
Tewning Road - East
Tewning Rd
3910100003
PC037
Ironbound Rd
0
150
300
600
Feet

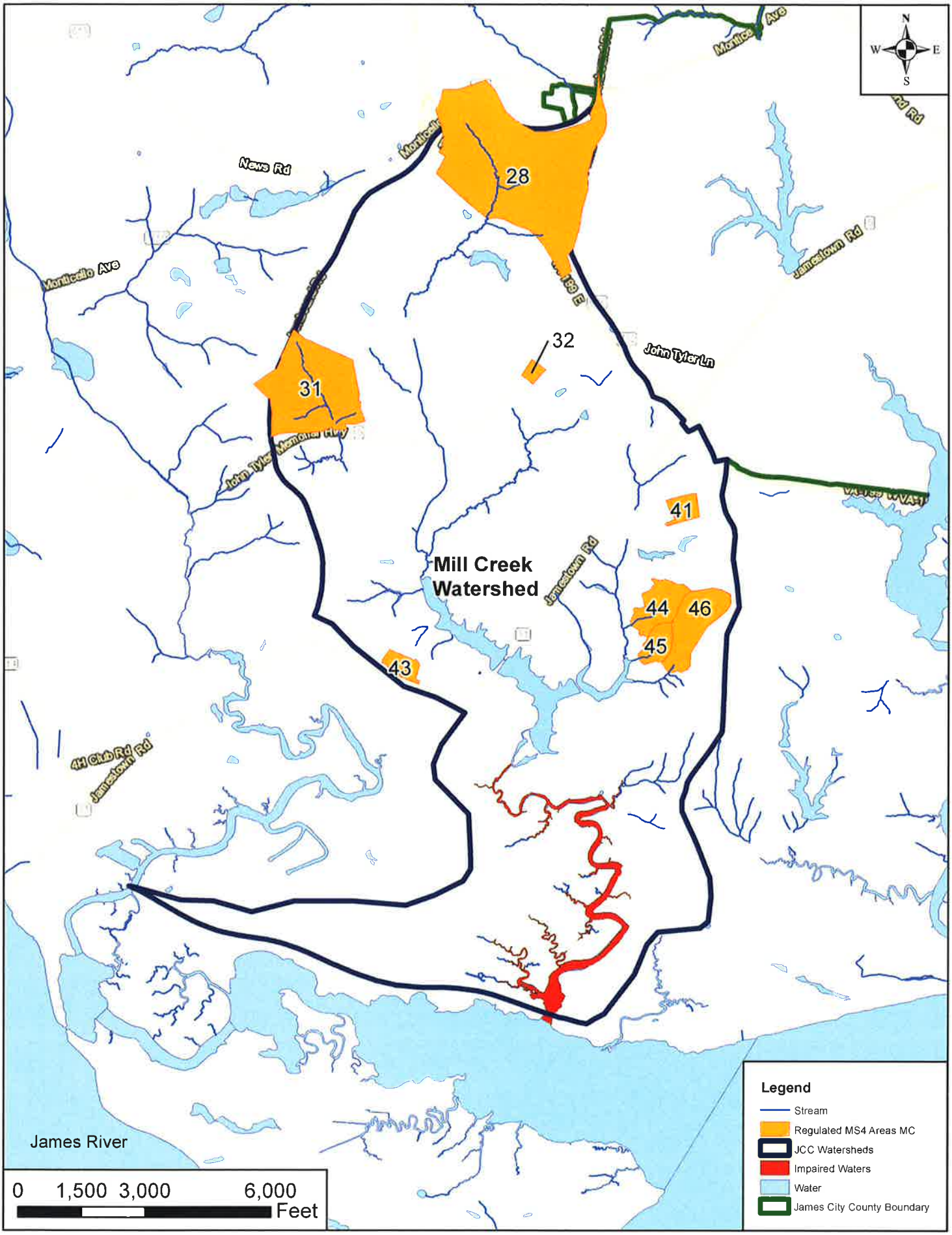

Regulated Area 30:
Mid County Park - North
3830100027
News Rd
Monticello Ave
PC288
3830100010
PC273
Ironbound Rd
Regulated Area 29:
Mid County Park - South
0
200
400
800
Feet


Regulated Area 34:
Jamestown High School - West
John Tyler Hwy
PC287
4610100002D
PC132
0
175
350
700
Feet


Regulated Area 35:
Jamestown High School - East
John Tyler Hwy
Eagle Way
4610100002D
Reades Way
PC210
PC133
0
300
600
1,200
Feet


Regulated Area 42:
Powhatan Creek Access
PC189
4730100001
Jamestown Rd
0
50
100
200
Feet

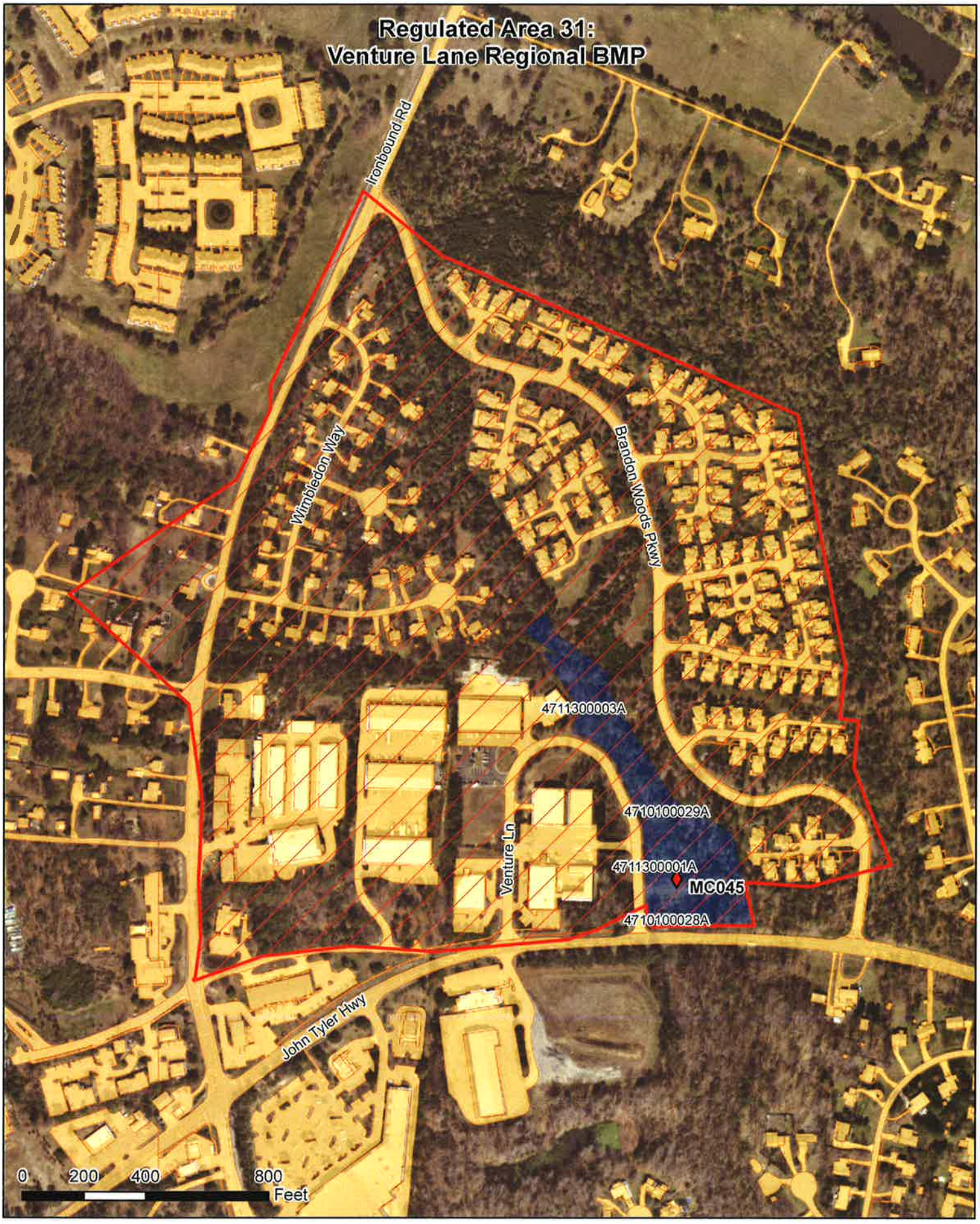

Regulated Area 36:
JCSA Water Treatment Facility
PC188
4710100058
4620100034
0 150 300 600
Feet
Regulated Area 37:
Clara Byrd Baker
Elementary School - North
Ironbound Rd
PC045
4710100058
0 100 200 400
Feet
Regulated Area 38:
Clara Byrd Baker
Elementary School - West
4710100058
PC046
0 75 150 300
Feet
Regulated Area 39:
Clara Byrd Baker
Elementary School - East
4710100058
PC078
PC077
Regulated Area 40:
Clara Byrd Baker
Elementary School - South
0 100 200 400
Feet



Appendix 1 - James City County Regulated Areas

Mill Creek Watershed Overview Map

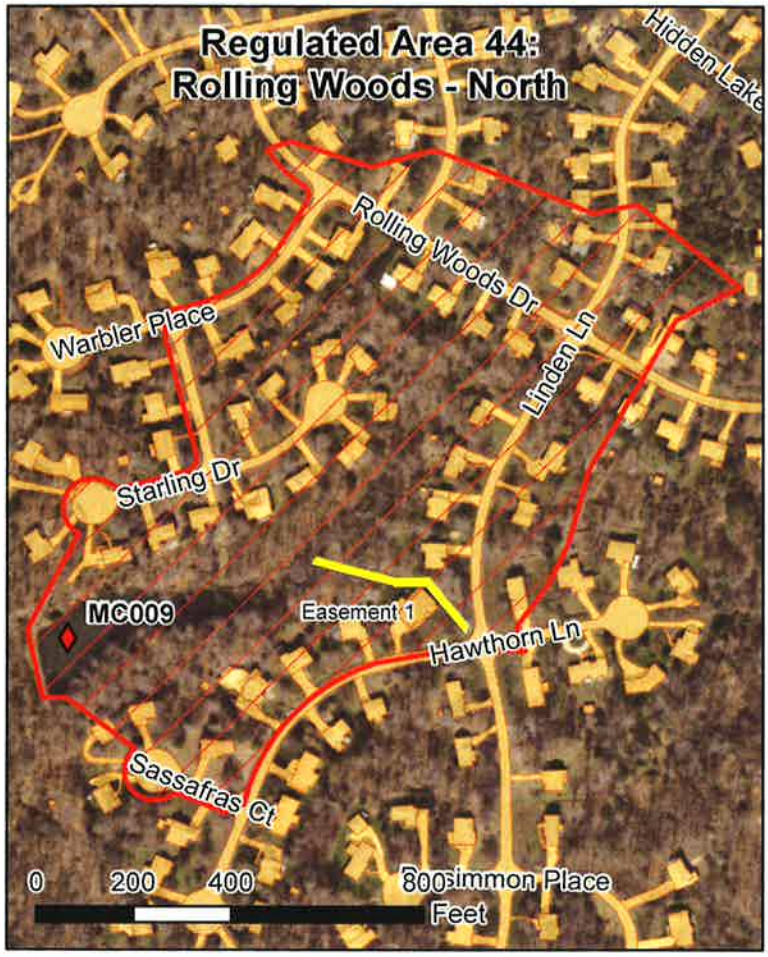

Regulated Area 28:
Mill Creek to Rt 199
Monticello Ave
3840100054
PC211
Ironbound Rd
Strawberry Plains Rd
Bradshaw Dr
3840100045
Easement 2
MC004
MC021
Easement 3
Route 199
3840100038B
3840100038
0
300
600
1,200
Feet


Regulated Area 31:
Venture Lane Regional BMP
Ironbound Rd
Wimbledon Way
Brandon Woods Pkwy
47113000003A
47101000029A
Venture Ln
47113000001A
MC045
47101000028A
John Tyler Hwy
0
200
400
800
Feet

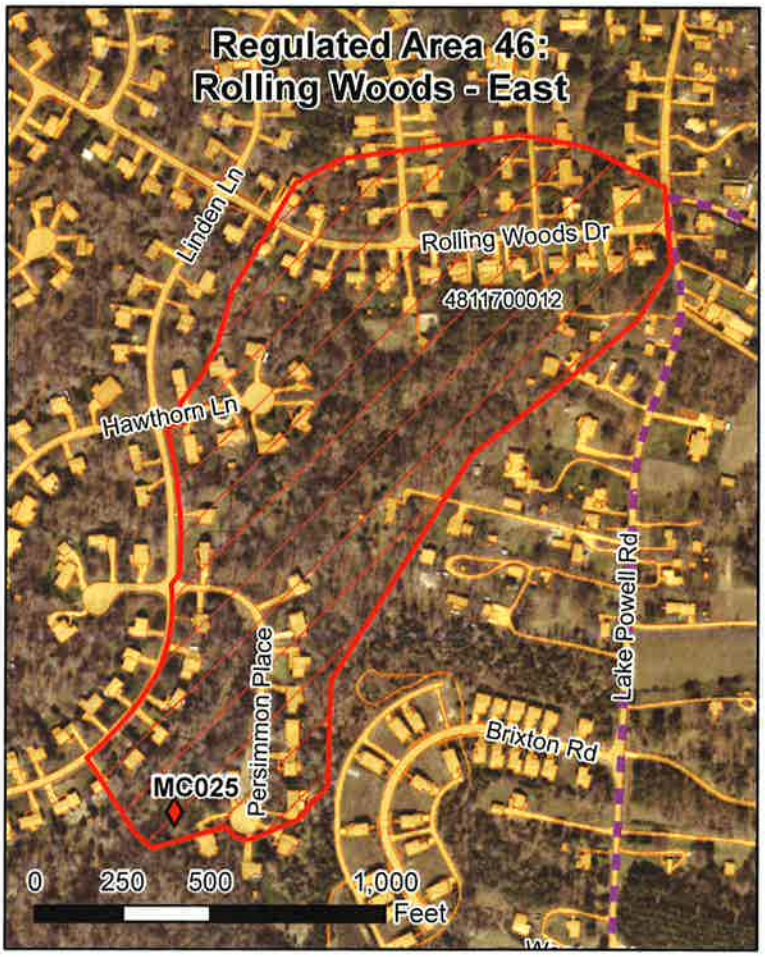

Regulated Area 32:
Fire Administration & Station 3
Carolina Blvd
Pilots Way
John Tyler Hwy
Queens Crossing
4721500001
MC070
0
100
200
400
Feet


Regulated Area 41:
Rawls Byrd Elementary School
Conway Dr
Brookwood Dr
James Sq
Laurel Ln
4810600171A
MC014
Colony Point Rd
Shore Dr
0
150
300
600
Feet


Regulated Area 43:
Lakewood Drive BMP
Lakewood Dr
Mill View Cir
Lakewood Dr
Jamestown Rd
PC252
0
150
300
600
Feet


Regulated Area 44:
Rolling Woods - North
Hidden Lake
Rolling Woods Dr
Warbler Place
Linden Ln
Starling Dr
MC009
Easement 1
Hawthorn Ln
Sassafras Ct
Persimmon Place
0 200 400 800
Feet


Regulated Area 45:
Rolling Woods - South
Hawthorn Ln
Sassafras Ct
Persimmon Place
MC024
Linden Ln
0 150 300 600
Feet


Regulated Area 46:
Rolling Woods - East
Linden Ln
Rolling Woods Dr
4811700012
Hawthorn Ln
Lake Powell Rd
Persimmon Place
Brixton Rd
MC025
0 250 500 1,000
Feet

Appendix 1 - James City County Regulated Areas

Skiffes Creek Watershed Overview Map


5230900001B
5230900001A
Regulated Area 48:
Grove Easement
Grove Heights Ave
Pocahontas Trail
Easement 4
5910100031
Magruder Ave
Ron Springs Dr
0
150
300
600
Feet

Appendix 2

Implementation Plan and Update of Programs and Actions Undertaken by Stakeholders

Stakeholders were identified and included in the development of the IP (attached) and its Action Plan elements and all aware that it will take a collaborative effort from federal, state, regional, local and non-governmental organizations to reduce fecal coliform concentrations within the impaired watersheds. Many of the management actions described in the IP have been underway since the development of the IP in 2011 and some other actions are scheduled for future implementation.

Table 7-1 from the IP (excerpted and attached) has been updated and summarizes the time frames for the identified actions to be implemented. Table 9-1 from the IP (also excerpted and attached) summarizes the roles, responsibilities and management actions of each agency indicating their responsibilities.

Table 7-1 Management Options for Implementation of Mill and Powhatan Creek TMDL 2016 UPDATE

Management Category	Management Option	Development Phase	June 2016 Status
Sanitary Sewer Improvements	Implementation of SSES Plan	Ongoing	Complete
	Implement schedule of Regional SSO Consent Order	Ongoing	Complete
	Participation in HRFOG education program	Ongoing	AskHRGreen.com
Septic System Programs	CBPA Septic Tank Pump Out and Inspection Information Program	Ongoing	Ongoing
	Update septic system locations through pump out program	Ongoing	Ongoing
	Field survey to estimate septic system failure rates	Phase I	Complete
	Implement procedures to address failing septic systems	Phase I	Complete
	Develop an onsite wastewater treatment funding program	Phase II	
	Increase enforcement actions for failing systems	Phase III	
Stormwater Quality Programs	Enforcement of Illicit Discharge provisions within the Stormwater Management Ordinance	Ongoing	Ongoing
	County rain barrel rebate program	Ongoing	Ongoing
	Private BMP Inspection and Maintenance Programs	Ongoing	Ongoing
	IDDE screening in Mill and Powhatan Creek watersheds	Phase I	Annually
	Coliscan Monitoring in Mill and Powhatan Creeks	Phase I	Monthly
	Participation in Regional Bacteria Source Tracking Study	Phase I	Ongoing
	Estimate Stormwater contribution to bacteria loading	Phase II	
	Investigate retrofits for wet ponds that would reduce bacteria	Phase I	Planned for FY17
	Retrofit wet ponds to reduce bacteria concentrations	Phase II	
Boating Programs	Sewer improvements and pump-out facility at County Marina	Phase I	Complete
	Expanded Boater Education Program	Phase II	
	Investigate No Discharge designation for Powhatan Creek	Phase III	
	Examine environmental benefits of No Wake Zones	Phase III	
Pet Waste Programs	Participation in HRSTORM regional education program	Ongoing	AskHRGreen.com
	County "Scoop the Poop" campaign	Ongoing	Ongoing
	Pet waste collectors in County Parks	Phase I	18 installed, Ongoing
	Free pet waste stations for neighborhoods	Phase I	25 installed, Ongoing
	Investigate viability of Pet Waste Ordinance	Phase III	
Aquatic Resource Restoration	County Stream Restoration Program	Ongoing	Ongoing
	Add wetlands restoration program	Phase III	
	Identify areas for sea grass restoration	Phase III	
Land Use Management	Chesapeake Bay Preservation Area Ordinance	Ongoing	Ongoing
	Implementation of Special Stormwater Criteria	Ongoing	Ongoing
	Enforcement JCC Erosion and Sediment Control Ordinance	Ongoing	Ongoing
	Implementation of JCC Guidelines for Design and Construction of Stormwater Management BMPs	Ongoing	Ongoing
	PRIDE Program	Ongoing	New - Clean Water Heritage Program
	Watershed Plan for Powhatan Creek Watershed	Complete	Complete
	Watershed Plan for Mill Creek Watershed	Phase I	Complete
	Implement bacteria priority areas in Powhatan Watershed	Phase II	
	Local Delegation of VSMP	Phase III	Complete
Wildlife Contribution Controls	BMP Buffer Management	Ongoing	Ongoing

Time Frame: Phase I: 7/1/2011-6/30/2016; Phase II: 7/1/2016-6/30/2021; Phase III: 7/1/2021-6/30/2016

Table 9-1: Management Actions and Responsible Stakeholders – 2016 UPDATE

Management Category	Management Option	Responsible Stakeholders	June 2016 Status
Sanitary Sewer Improvements	Implementation of SSES Plan	JCSA	HRSD
	Implement schedule of Regional SSO Consent Order	JCSA	HRSD
	Participation in HRFOG education program	JCSA	JCSA
Septic System Programs	CBPA Septic Tank Pump Out and Inspection Information Program	JCC	JCC
	Update septic system locations through pump out program	JCC	JCC
	Field survey to estimate septic system failure rates	JCC	JCC
	Implement procedures to address failing septic systems	JCC/VDH	JCC/VDH
	Develop an onsite wastewater treatment funding program	JCC/VDH/DCR	JCC/VDH/DEQ
	Increase enforcement actions for failing systems	VDH	VDH
Stormwater Quality Programs	Enforcement of Illicit Discharge provisions within the Stormwater Management Ordinance	JCC	JCC
	County rain barrel rebate program	JCC	JCC
	Private BMP Inspection and Maintenance Programs	JCC	JCC
	IDDE screening in Mill and Powhatan Creek watersheds	JCC	JCC
	Coliscan Monitoring in Mill and Powhatan Creeks	JCC	JCC
	Participation in Regional Bacteria Source Tracking Study	JCC	JCC
	Estimate Stormwater contribution to bacteria loading	JCC	JCC
	Investigate retrofits for wet ponds that would reduce bacteria	JCC	JCC
	Retrofit wet ponds to reduce bacteria concentrations	JCC	JCC
Boating Programs	Sewer improvements and pump-out facility at County Marina	JCC	JCC
	Expanded Boater Education Program	JCC	JCC
	Investigate No Discharge designation for Powhatan Creek	JCC	JCC
	Examine environmental benefits of No Wake Zones	JCC	JCC
Pet Waste Programs	Participation in HRSTORM regional education program	JCC/DCR	JCC/HRPDC
	County "Scoop the Poop" campaign	JCC/DCR	JCC/HRPDC
	Pet waste collectors in County Parks	JCC/DCR	JCC/HRPDC
	Free pet waste stations for neighborhoods	JCC/DCR	JCC/HRPDC
	Investigate viability of Pet Waste Ordinance	JCC	JCC/HRPDC
Aquatic Resource Restoration	County Stream Restoration Program	JCC	JCC
	Add wetlands restoration program	JCC	JCC/DEQ
	Identify areas for sea grass restoration	JCC	JCC/DEQ
Land Use Management	Chesapeake Bay Preservation Area Ordinance	JCC	JCC
	Implementation of Special Stormwater Criteria	JCC	JCC
	Enforcement JCC Erosion and Sediment Control Ordinance	JCC	JCC
	Implementation of JCC Guidelines for Design and Construction of Stormwater Management BMPs	JCC	JCC
	PRIDE Program	JCC	JCC
	Watershed Plan for Powhatan Creek Watershed	JCC	JCC
	Watershed Plan for Mill Creek Watershed	JCC	JCC
	Implement bacteria priority areas in Powhatan Watershed	JCC	JCC
	Develop special stormwater criteria for Mill Creek Watershed	JCC	JCC
	Local Delegation of VSMP	JCC	JCC
Wildlife Contribution Controls	BMP Buffer Management	JCC	JCC

Implementation Plan for Fecal Coliform TMDL (Total Maximum Daily Load) for Mill Creek and Powhatan Creek

DEQ
Virginia Department of Environmental Quality

Hampton Roads PDC
Planning District Commission

James City County
Jamestown 1607

June 2011

PEP11-04

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REPORT DOCUMENTATION

TITLE:
Implementation Plan for the
Fecal Coliform TMDL for Mill Creek
and Powhatan Creek.

REPORT DATE
April 2011

GRANT/SPONSORING AGENCY
Department of Environmental Quality/James City County

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ABSTRACT

The Mill and Powhatan Creek Watersheds are located within James City County in Southeastern Virginia. In response to Section 303(d) of the Clean Water Act, the Virginia Department of Environmental Quality (VADEQ) listed portions of Mill Creek and Powhatan Creek beginning with Virginia's 1998 Section 303(d) list for being unable to attain the water quality standard for primary contact recreational waters due to elevated levels of fecal coliform bacteria.

The Virginia Department of Environmental Quality completed the "Bacteria Total Maximum Daily Load for Mill Creek and Powhatan Creek," in March 2008. The Mill and Powhatan Study set allocations to limit bacteria pollutant loads discharged to the watersheds to levels that were modeled to achieve compliance with the state water quality criteria for bacteria for primary contact recreational waters. This Implementation Plan bridges the gap between those specified pollutant load allocations and actual reductions in bacteria counts in Mill and Powhatan creeks by recommending a set of actions to be taken in the watersheds during a fifteen year project timeframe.

ACKNOWLEDGMENTS

This report was prepared by the Hampton Roads Planning District Commission (HRPDC) in cooperation with the Virginia Department of Environmental Quality, Virginia Department of Conservation and Recreation, Virginia Department of Health and James City County, Virginia.

Funding to support this project was provided by the Virginia Department of Environmental Quality, James City County and the HRPDC.

IMPLEMENTATION PLAN FOR THE FECAL COLIFORM TMDL (TOTAL MAXIMUM DAILY LOAD) FOR MILL CREEK AND POWHATAN CREEK

This report was funded, in part, through a grant from the Virginia Department of Environmental Quality and through a contract with James City County.

Preparation of this report was included in the HRPDC Unified Planning Work Program for FY 2008-2009, approved by the Commission at its Executive Committee Meeting of March 19, 2008, in the HRPDC Unified Planning Work Program for FY 2009-2010, approved by the Commission at its Executive Committee Meeting of June 17, 2009 and in the HRPDC Unified Planning Work Program for FY 2010-2011, approved by the Commission at its Executive Committee Meeting of June 16, 2010.

Prepared by the staff of the Hampton Roads Planning District Commission

April 2011

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1.0 EXECUTIVE SUMMARY

1.1 Introduction

This Implementation Plan (IP) is a companion document to the report, "Bacteria Total Maximum Daily Load for Mill Creek and Powhatan Creek" (DEQ 2008). The Mill and Powhatan Creeks TMDL Study set allocations to limit bacteria pollutant loads discharged to the Mill Creek and Powhatan Creek watersheds to levels that were modeled to achieve compliance with the state water quality criteria for bacteria for primary contact recreation. This IP bridges the gap between those specified pollutant load allocations and actual reductions in bacteria counts in Mill and Powhatan Creek by recommending a set of actions to be taken in the watersheds during a fifteen year project timeframe.

Two sets of regulatory requirements for the development of TMDL IPs are applicable in the state of Virginia.

- §303(d) of the Federal Water Pollution Control Act of 1972 commonly known as the Clean Water Act (CWA)
- Virginia Water Quality Monitoring, Information and Restoration Act of 1997 (WQMIRA)

CWA strives "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." The inception of the federal TMDL program is found in section 303(d) of that legislation. WQMIRA requires the State to develop reports assessing water quality of state waters, to provide data to develop programs addressing water quality impairments, to develop TMDLs and to develop IPs.

1.2 Review of Mill Creek and Powhatan Creek Bacteria TMDL

Mill Creek (VAT-G10E-03) was initially listed as impaired on Virginia's 2002 303(d) Report on Impaired Waters due to exceedances of Virginia's water quality standard for fecal coliform. In January 2003, Virginia adopted a water quality standard for enterococci bacteria for saltwater and transition zones. Mill Creek was listed as not supporting the Recreation Use on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report (VADEQ, 2006) due to water quality violations of the enterococci bacteria standard.

Powhatan Creek has two segments that have been identified as impaired and do not support the Recreation Use. Segment VAT-G10E-01, the tidal segment of Powhatan Creek, was listed in Virginia's 1998 303(d) TMDL Priority List and Report because of violations of the fecal coliform water quality standard. The tidal segment of Powhatan Creek is currently listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the enterococci bacteria standard.

Sufficient exceedances of the fecal coliform bacteria standard in the nontidal segment (VAT-G10R-02) led to a listing in the 2002 305(b)/303(d) Water Quality Assessment Integrated Report. The non-tidal segment of Powhatan Creek is listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the *E. coli* bacteria standard.

A TMDL study for the Mill Creek and Powhatan Creek watersheds, completed by DEQ in March 2008, examined the watershed characteristics and the sources of fecal coliform to the creeks. Using monitoring data, bacterial source tracking (BST), and watershed models, DEQ assigned maximum allowable loads to each source in the watersheds in order to bring Mill and Powhatan Creeks into compliance with the water quality standard for primary contact recreation. Table 1-1 outlines the source reductions necessary (as estimated by the model) in order for Mill and Powhatan Creeks to achieve water quality standards.

Table 1-1: TMDL Reduction in Fecal Coliform Loadings from Existing Conditions

Impaired Waterbody	Agriculture	Wildlife Direct Deposit	Residential	Forest	Marinas and Canal
Mill Creek	92%	92%	92%	0%	0%
Powhatan Creek	92%	92%	92%	0%	100%

The core of this IP is a set of actions found in Section 7 aimed to reduce the levels of fecal coliform bacteria in Mill and Powhatan Watersheds. The actions chiefly target bacteria from human and pet ("anthropogenic") sources. This reflects the staged implementation recommended by the Virginia Department of Environmental Quality and referenced in the TMDL Study.

1.3 Public Participation

Two public meetings were held in the watershed to engage the public in the development of the TMDL Implementation Plan for the Mill and Powhatan Creek Watersheds. A work group composed of representatives from County departments, the Hampton Roads Planning District Commission (HRPDC), and state and federal agencies was formed to guide development of the TMDL IP.

1.4 Implementation Actions

The management actions outlined in this IP capitalize on existing and planned programs and efforts within the Mill and Powhatan Creek watersheds and will be implemented in four phases. Ongoing actions have already been initiated in response to other regulatory programs, but are expected to reduce bacteria loads to the waterbodies. Phase I actions are those that have been recently initiated or will be initiated in the near future in response to the TMDL and are scheduled for completion within five years. Phase II activities are those that are planned for implementation within the next five to ten years and may not have approved funding sources yet. Phase III actions may require regulatory changes, so they may be implemented as necessary if actions undertaken in the previous phases do not significantly improve water quality within the study area. All management actions were divided into the following eight management categories:

- Sanitary Sewer System Improvements
- Septic System Programs

- Stormwater Quality Programs
- Boating Programs
- Pet Waste Programs
- Aquatic Resources Restoration
- Land Use Management
- Wildlife Contribution Controls

1.5 Associated Costs and Benefits

The primary benefit of the implementation of the management actions described in this IP is the reduction of bacteria levels in the Mill Creek and Powhatan Creek watersheds. The programs and actions contained within this IP will serve to reduce the anthropogenic sources of bacteria within the watersheds. Because many of the programs mentioned in this report also serve purposes beyond reducing bacteria and cover areas larger than the Mill and Powhatan Creek watersheds, the costs of reducing bacteria levels can be difficult to estimate. James City County staff estimated costs for management categories using knowledge of current program costs and best professional judgment.

1.6 Measurable Goals and Milestones

The goal of the TMDL developed for Mill and Powhatan Creeks is to bring the impaired water segments within the watersheds into compliance with the water quality standard for bacteria for primary contact recreation. Once the water segment achieves compliance with the bacteria criteria, then the segment can be removed from the 303(d) Impaired Waters List. Throughout the fifteen year project timeframe, DEQ will continue its monitoring of stations in the Mill and Powhatan watersheds. Currently, this monitoring program includes 1 monitoring station at the mouth of Mill Creek and 3 stations on Powhatan Creek. Project progress will be tracked throughout the timeframe of the implementation plan, and the effectiveness of the management actions proposed in this IP will be evaluated at the end of five, ten, and fifteen years.

1.7 Stakeholders Roles and Responsibilities

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Stakeholder participation and support is essential for achieving the goals of this TMDL effort. Stakeholders for this project were identified at the beginning of IP development and invited to sit on the Technical Advisory Committee along with agency representatives and County staff.

1.8 Watershed Planning Efforts

In 2001, James City County hired the Center for Watershed Protection to develop the Powhatan Creek Watershed Management Plan. In 2009, the County hired Vanasse Hangen Brustlin, Inc (VHB) and began the process of developing a watershed management plan for Mill Creek. The

Mill Creek Watershed Management Plan will follow the outline and approach established during the development of the Powhatan Creek plan and is expected to be complete summer 2011.

As part of the James City County watershed planning process, three special studies were performed to gain a better scientific understanding of the Powhatan stream system; these included the stream and floodplain assessment, the conservation area study, and the Stormwater Management Master Plan. The stream and floodplain assessment consisted of an instream habitat survey for the majority of the non-tidal watershed and reported on stream channel stability and habitat conditions in each of the subwatersheds. The conservation area study identified the presence of rare, threatened or endangered (RTE) species, contiguous forest and high quality wetlands and identified potential threats and impacts to their existence. The stormwater master plan developed specific stormwater criteria for subwatersheds, identified existing stormwater practices for retrofit possibilities, and located potential regional stormwater facilities.

The watershed management plan provides a summary of the findings from the Powhatan Creek baseline report, the three special studies, and the stakeholder process conducted by the Center for Watershed Protection, the James River Association and James City County. A specific watershed management plan and accompanying maps were drafted for the twelve subwatersheds based on the eight tools of watershed protection.

The goals of the study were to prevent further degradation of the water quality of Powhatan Creek, maintain the quality of the creek's wetlands, maintain biological and habitat diversity, and promote habitat connectivity. The sub-watershed boundaries of the Powhatan Watershed Plan were compared to the boundaries for the TMDL. The Powhatan TMDL study subwatersheds were delineated to match, to the extent possible, those created for the Powhatan Watershed Plan. This was done to ensure that information developed as a part of the Powhatan TMDL could also be used for implementation of the Powhatan Watershed Plan.

1.9 Potential Funding Sources

One of the objectives of this TMDL Implementation Plan is to maximize utilization of existing programs and resources to achieve the goal of reducing bacteria levels within the Mill and Powhatan Watersheds. In general, funding for these programs and the management actions described in this IP will come from four sources as they are available:

- Locality funds
- Private / nonprofit funds
- Virginia State funds
- Federal funds

2.0 INTRODUCTION

2.1 Purpose, Scope, and Timeframe

This Implementation Plan (IP) is a companion document to the report "Bacteria Total Maximum Daily Load for Mill Creek and Powhatan Creek" completed by the Virginia Department of Environmental Quality (DEQ) in March 2008, which will henceforth be referred to as the TMDL Study. The IP creates a framework to achieve the reductions in bacteria counts recommended in the TMDL Study. The core of this IP is the set of actions presented in Section 7 intended to reduce the levels of bacteria in Mill and Powhatan Creek watersheds from anthropogenic sources. The goal of the IP is compliance with the State of Virginia water quality standard for bacteria for primary contact recreation. This IP follows the State guidance for TMDL implementation plans published by DEQ and DCR.

The TMDL study that was approved by the US Environmental Protection Agency (USEPA) in April 2009 and the Virginia State Water Control Board in July 2009 examined the watersheds, their characteristics, and the sources of bacteria throughout the watersheds. Using monthly monitoring data, bacterial source tracking (BST), Hydrological Simulation Program-FORTRAN (HSPF) and a tidal volumetric model, DEQ was able to assign maximum allowable loads to each source in the watersheds in order to bring Mill Creek and Powhatan Creek into compliance with the water quality standard.

This IP outlines a strategy and the proposed actions to reduce anthropogenic loading of bacteria to the level set forth in the TMDL study in order to comply with the water quality standard for bacteria in primary contact recreational waters. The proposed actions included in this IP will be performed by James City County and state, federal, and non-governmental partners. These actions are expected to be completed within a ten to fifteen year timeframe.

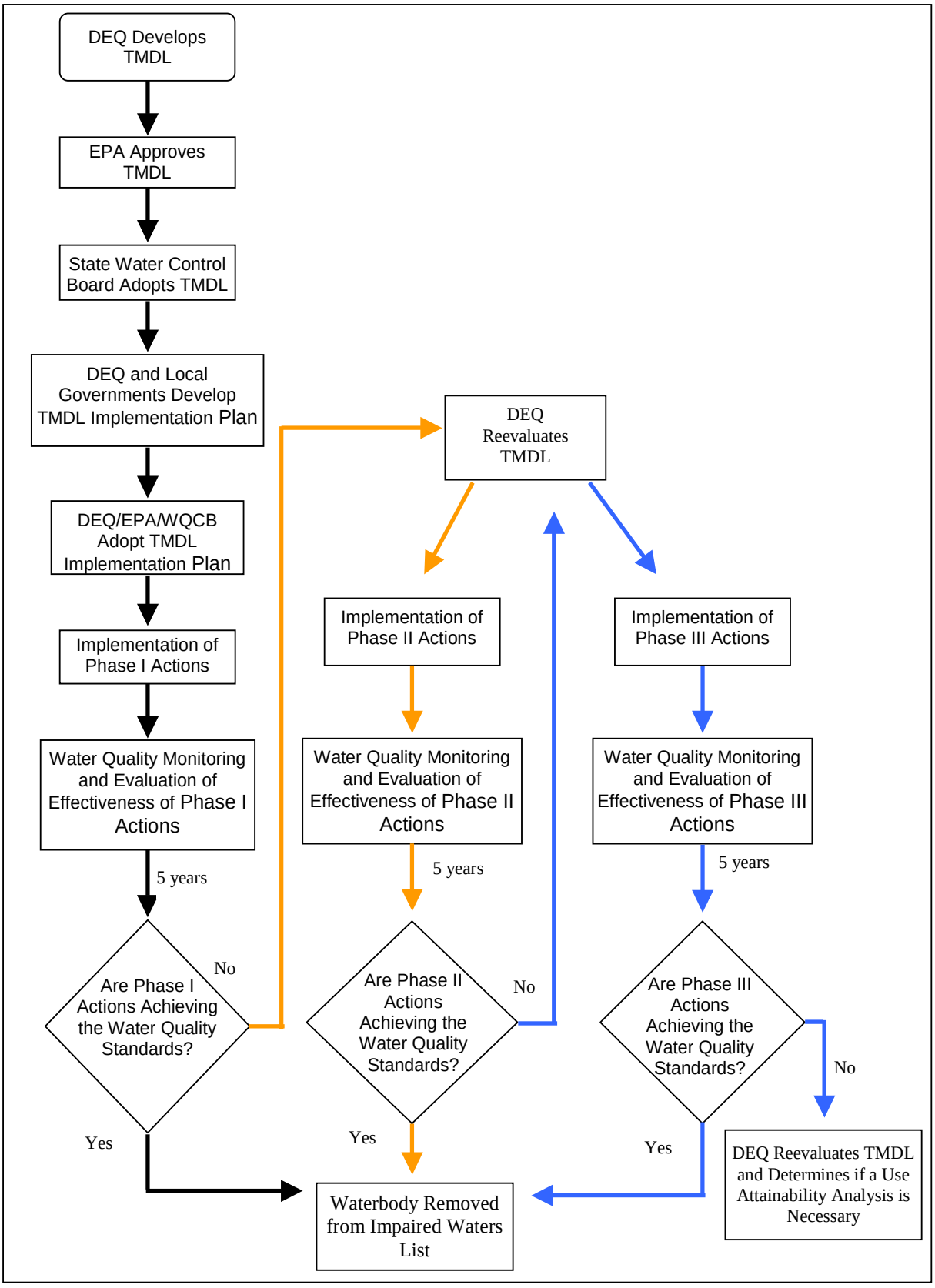
The pollutant reductions in Mill and Powhatan Watersheds will be implemented in a staged fashion. Staged implementation is an iterative process that first addresses those sources with the largest impact on water quality. Stage 1 management actions will target the controllable, anthropogenic bacteria sources identified in the TMDL, setting aside control strategies for wildlife except for cases of over population. During the implementation of the stage 1 scenario, all controllable sources will be reduced to the maximum extent practicable using an iterative approach. DEQ will re-assess water quality data during and subsequent to the implementation of the stage 1 scenario to determine if the water quality standard is attained.

Stage 1 implementation management actions will be divided into four phases. Ongoing actions have already been initiated in response to other regulatory programs, but are expected to reduce bacteria loads to the waterbodies. Phase I actions are those that have been recently initiated or will be initiated in the near future in response to the TMDL and are scheduled for completion within five years. Phase II activities are those that are planned for implementation within the next five to ten years and may not have approved funding sources yet. Phase III actions may require regulatory changes, and they may be implemented as necessary if Phase I

and Phase II actions do not significantly improve water quality within the study area. Stage 1 implementation actions are discussed in greater detail in Section 7.

In some water bodies for which TMDLs have been developed, water quality modeling indicates that even after removal of all bacteria sources (other than wildlife), the water body may not attain standards under all flow regimes at all times. Such is the case for Mill Creek, this water body may not be able to attain standards without some reduction in wildlife load. Virginia and EPA are not proposing the elimination of wildlife to allow for the attainment of water quality standards. While managing over populations of wildlife remains as a limited option to local stakeholders, the reduction of wildlife or changing of a natural background condition is not the intended goal of a TMDL. If water quality standards are not being met after implementation of stage 1 management actions, then it may be determined through a Use Attainability Analysis (UAA) (Stage II) that primary contact recreation is not a viable use for Mill Creek. The UAA process is discussed in greater detail in Section 7.2.

Figure 2-1: Decision Tree for Approval and Revision of TMDL



2.2 Regulatory Background

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies which are exceeding water quality standards. TMDLs represent the total pollutant loading that a water body can receive without violating water quality standards. Water quality standards are numeric or narrative limits on pollutants that are developed to ensure the protection of human health and aquatic life. The TMDL process establishes the allowable loading of pollutants for a water body based on the relationship between pollution sources and in-stream water quality conditions. By following the TMDL process, states can establish water quality based controls to reduce pollution from both point and non-point sources to restore and maintain the quality of their water resources (EPA 1991).

In accordance with Federal regulations at 40 CFR § 130.7, a TMDL must comply with the following requirements: (1) designed to attain and maintain the applicable water quality standards, (2) include a total allowable loading and as appropriate, wasteload allocations (WLAs) for point sources and load allocations for nonpoint sources, (3) consider the impacts of background pollutant contributions, (4) take critical stream conditions into account (the conditions when water quality is most likely to be violated), (5) consider seasonal variations, (6) include a margin of safety (which accounts for uncertainties in the relationship between pollutant loads and in-stream water quality), (7) consider reasonable assurance that the TMDL can be met, (8) be subject to public participation.

Once a TMDL is developed and approved by EPA, measures must be taken to reduce pollution levels in the stream. These measures, which can include the use of better treatment technology and the installation of best management practices (BMPs), are implemented in a staged process that is described along with specific BMPs in the IP. In general, the Commonwealth intends for the pollutant reductions to be implemented in a staged fashion. Staged implementation is an iterative process that first addresses those sources with the largest impact on water quality.

2.3 Designated Use and Water Quality Standard

According to Virginia Water Quality Standards (9 VAC 25-260-5), the term "water quality standards means provisions of state or federal law which consist of a designated use or uses for the waters of the Commonwealth and water quality criteria for such waters based upon such uses. Water quality standards are to protect the public health or welfare, enhance the quality of water and serve the purposes of the State Water Control Law (§62.1-44.2 et seq. of the Code of Virginia) and the federal Clean Water Act (33 USC §1251 et seq.)."

According to Virginia Water Quality Standards (9 VAC 25-260-10A), "all state waters are designated for the following uses: recreational uses (e.g., swimming and boating); the propagation and growth of a balanced indigenous population of aquatic life, including game fish, which might be reasonably expected to inhabit them; wildlife; and the production of edible and marketable natural resources (e.g., fish and shellfish)."

Section 9 VAC 25-260-170 is the applicable water quality criteria for fecal coliform impairments. Prior to 2002, Virginia Water Quality Standards specified the following criteria for a nonshellfish supporting waterbody to be in compliance with Virginia's fecal standard for contact recreational use:

> *A. General requirements. In all surface waters, except shellfish waters and certain waters addressed in subsection B of this section, the fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 ml of water for two or more samples over a 30-day period, or a fecal coliform bacteria level of 1,000 per 100 ml at any time.*

If the waterbody had an exceedance rate > 10.5% and had at least two exceedances, the waterbody was classified as impaired and the development and implementation of a TMDL was indicated in order to bring the waterbody into compliance with the water quality criterion. Based on the sampling frequency, only one criterion was applied to a particular datum or data set. If the sampling frequency was one sample or less per 30 days, the instantaneous criterion was applied; for a higher sampling frequency, the geometric criterion was applied. This was the criterion used for listing the impairments included in this study. Sufficient fecal coliform bacteria standard violations were recorded at VADEQ water quality monitoring stations to indicate that the recreational use designations are not being supported.

The EPA has since recommended that all states adopt an *E coli* or *enterococci* standard for fresh water and *enterococci* criteria for marine waters. The adoption of the *E. coli* and *enterococci* standard went into effect January 15, 2003 in Virginia. The new criteria, used in developing the bacteria TMDL in this study, are outlined in 9 VAC 25-260-170 and reads as follows:

> *A. In surface waters, except shellfish waters and certain waters identified in subsection B of this section, the following criteria shall apply to protect primary contact recreational uses:*
>
> *1. Fecal coliform bacteria shall not exceed a geometric mean of 200 fecal coliform bacteria per 100 ml of water for two or more samples over a calendar month nor shall more than 10% of the total samples taken during any calendar month exceed 400 fecal coliform bacteria per 100 ml of water. This criterion shall not apply for a sampling station after the bacterial indicators described in subdivision 2 of this subsection have a minimum of 12 data points or after June 30, 2008, whichever comes first.*
>
> *2. E. coli and enterococci bacteria per 100 ml of water shall not exceed the following:*

Standard	***Geometric Mean[1]***	***Single Sample Maximum[2]***
Freshwater[3] *E. coli*	*126*	*235*
Saltwater and Transition Zone[3] *Enterococci*	*35*	*104*

[1] For two or more samples taken during any calendar month.

[2] No single sample maximum for *enterococci* and *E. coli* shall exceed a 75% upper one-sided confidence limit based on a site-specific log standard deviation. If site data are insufficient to establish a site-specific log standard deviation, then 0.4 shall be used as the log standard deviation in freshwater and 0.7 shall be as the log standard deviation in saltwater and transition zone. Values shown are based on a log standard deviation of 0.4 in freshwater and 0.7 in saltwater.

[3] See 9 VAC 25-260-140 C for freshwater and transition zone delineation.

2.4 Mill and Powhatan Creek TMDL Development Efforts

Mill Creek (VAT-G10E-03) was initially listed as impaired on Virginia's 2002 303(d) Report on Impaired Waters due to exceedances of Virginia's water quality standard for fecal coliform. In January 2003, Virginia adopted a water quality standard for enterococci bacteria for saltwater and transition zones and the previous fecal coliform bacteria criteria no longer apply. Mill Creek was listed as not supporting the Recreation Use on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report (VADEQ, 2006) due to water quality violations of the enterococci bacteria standard.

Powhatan Creek has two segments that have been identified as impaired and do not support the Recreation Use. Segment VAT-G10E-01, the tidal segment of Powhatan Creek, was listed in Virginia's 1998 303(d) TMDL Priority List and Report because of violations of the fecal coliform water quality standard. The tidal segment of Powhatan Creek is currently listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the enterococci bacteria standard.

Sufficient exceedances of the fecal coliform bacteria standard in the non-tidal segment (VAT-G10R-02) led to a listing in the 2002 305(b)/303(d) Water Quality Assessment Integrated Report. The non-tidal segment of Powhatan Creek is currently listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the *E. coli* bacteria standard. The non-tidal segment was determined to be meeting water quality standards during the 2008 Water Quality Assessment.

A TMDL study for the Mill and Powhatan Creek watersheds, completed by DEQ in March 2008, examined the watershed characteristics and the sources of fecal coliform to the creeks. Using monitoring data, bacterial source tracking (BST), and watershed models, DEQ assigned maximum allowable loads to each source in the watersheds in order to bring Mill and Powhatan Creeks into compliance with the water quality standard for primary contact recreation.

2.5 Mill and Powhatan Watersheds

Mill Creek and Powhatan Creek are part of the James River basin. The watersheds are mainly within James City County with a small portion in the City of Williamsburg. The land use distributions in the Mill Creek and Powhatan Creek watersheds are very similar and are mainly composed of forest, but with significant residential areas. Agricultural areas are very small and are composed of cropland with small amounts of pasture. Both Mill Creek and Powhatan Creek flow into the James River (USGS Hydrologic Unit Code11010002), which discharges into the Chesapeake Bay at Hampton Roads harbor in southeast Virginia.

The vast majority of the Mill and Powhatan watersheds are located in the Chesapeake Rolling Coastal Plain level IV ecoregion which is a subset of the Southeastern Plains ecoregion (Figure 2.1). The Chesapeake Rolling Coastal Plain ecoregion is composed of "hilly upland with narrow stream divides, incised streams, and well-drained loamy soils" (Woods et al., 1999). Natural vegetation is "mostly Oak-Hickory-Pine Forest (dominants: hickory, longleaf pine, shortleaf pine, loblolly pine, white oak and post oak)" (Woods et al., 1999). Currently, "urbanization and

residential development are extensive" and "less intensive agriculture, general farming, or part time agriculture occurs; the landuse mosaic is distinct from the more forested rolling, Inner Coastal Plain" (Woods et al.1999).

Figure 2-2-1 Location of Mill and Powhatan Watersheds

3.0 STATE AND FEDERAL REQUIREMENTS

3.1 State Requirements

The TMDL Implementation Plan is a requirement of Virginia's 1997 Water Quality Monitoring, Information, and Restoration Act (§62.1-44.19:4 through 19:8 of the Code of Virginia), or WQMIRA. WQMIRA directs the Virginia Department of Environmental Quality (DEQ) to "develop and implement a plan to achieve fully supporting status for impaired waters." In order for Implementation Plans to be approved by the Commonwealth, they must include the following:

- Date of expected achievement of water quality objectives;
- Measurable goals;
- Necessary corrective actions;
- Associated costs, benefits, and environmental impact of addressing the impairment.

3.2 Federal Requirements

Section 303(d) of the CWA and current EPA regulations do not require the development of implementation strategies. EPA does, however, outline the minimum elements of an approvable IP in its 1999 "Guidance for Water Quality-Based Decisions: The TMDL Process". The listed elements include:

- A description of the implementation actions and management measures,
- A time line for implementing these measures,
- Legal or regulatory controls,
- The time required to attain water quality standards, and
- A monitoring plan and milestones for attaining water quality standards.

4.0 REVIEW OF TMDL DEVELOPMENT

4.1 Description of Watershed Characteristics

Mill Creek and Powhatan Creek are part of the James River basin. The watersheds are mainly within James City County with a small portion in the city of Williamsburg. Both Mill Creek and Powhatan Creek flow into the James River (USGS Hydrologic Unit Code11010002), which discharges into the Chesapeake Bay at Hampton Roads harbor in southeast Virginia (DEQ 2008).

Using data from the Mid-Atlantic Regional Earth Science Application Center (RESAC) (RESAC, 2000), land uses were grouped into four major categories based on similarities in hydrologic features and bacteria source characteristics. The land use distribution in the Mill Creek and Powhatan Creek watersheds are very similar and are mainly composed of forest, but with significant residential areas. Agricultural areas are very small and are composed of cropland with small amounts of pasture. Land use distribution is displayed graphically in Figure 4.1 and listed in Table 4.1 (DEQ 2008).

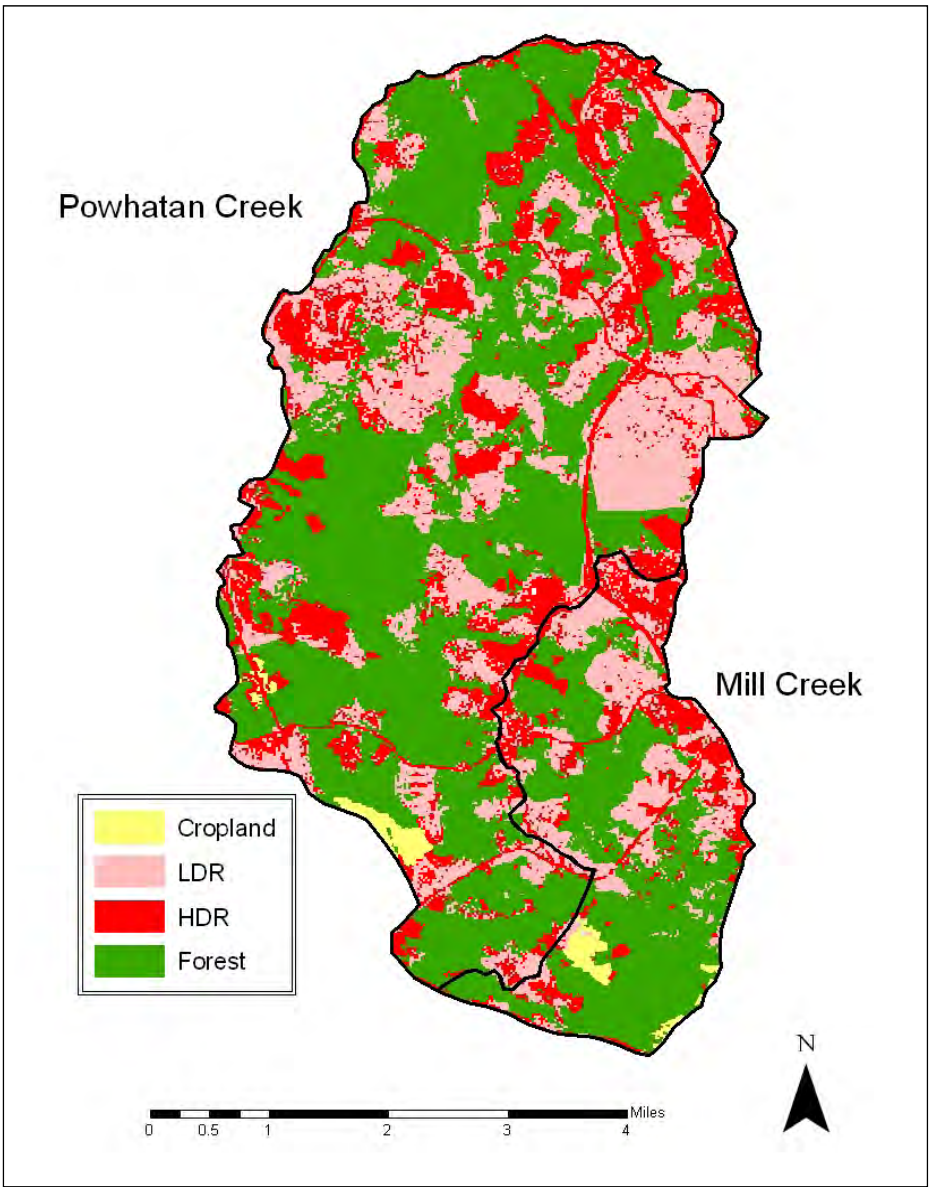
The vast majority of the Mill and Powhatan watersheds are located in the Chesapeake Rolling Coastal Plain level IV ecoregion which is a subset of the Southeastern Plains ecoregion (Figure 2.1). The Chesapeake Rolling Coastal Plain ecoregion is composed of “hilly upland with narrow stream divides, incised streams, and well-drained loamy soils” (Woods et al., 1999). Natural vegetation is “mostly Oak-Hickory-Pine Forest (dominants: hickory, longleaf pine, shortleaf pine, loblolly pine, white oak and post oak)” (Woods et al., 1999). Currently, “urbanization and residential development are extensive” and “less intensive agriculture, general farming, or part time agriculture occurs; the landuse mosaic is distinct from the more forested rolling, Inner Coastal Plain” (Woods et al.1999).

The Mill Creek and Powhatan Creek watersheds lie entirely in the North Atlantic Coastal Plain. This physiographic section is characterized by “sedimentary deposits that range in age from Early Cretaceous to Holocene” (USGS, 1997). There are three predominant State Soil Geographic (STATSGO) soil groups found in the Mill Creek and Powhatan Creek watersheds Hydrologic soil groups describe soil texture in terms of potential for surface runoff and infiltration rates. For example, soils in hydrologic group “A” pass a larger proportion of rainfall through to groundwater than soils in hydrologic group “B.” Conversely, soils in hydrologic group “D” inhibit infiltration such that a large proportion of rainfall contributes to surface runoff and therefore a more direct path to stream channels. The fraction of rainfall that either runs off or infiltrates will impact the bacteria loads transported to streams during storm events.

Table 4-1: 2000 Land Use in Mill and Powhatan Watersheds (DEQ 2008)

	Mill Creek		Powhatan Creek	
Landuse	Area (acres)	Percentage of Watershed	Area (acres)	Percentage of Watershed
Cropland	83	2%	111	1%
Pasture	10	<1%	5	<1%
Low Density	962	25%	3748	27%
High Density	742	20%	2986	21%
Forest	1988	53%	7160	51%

Figure 4-1: 2000 Land Use in Mill Creek and Powhatan Creek Watersheds (DEQ 2008)



4.2 Description of Impairment

Pollution from both point and nonpoint sources can lead to fecal coliform bacteria contamination of water bodies. Fecal coliform bacteria are found in the intestinal tract of warm-blooded animals. Although most fecal coliform are not pathogenic, their presence in water indicates contamination by fecal material. For contact recreational activities such as swimming, health risks increase with increasing fecal coliform counts. If the fecal coliform concentration in a water body exceeds state water quality standards, the water body is listed for violation of the contact recreational use. Virginia has recently adopted an *Escherichia coli* (*E. coli*) water quality standard for freshwater and an enterococci standard for saltwater and transition zones for surface waters. The concentrations of these organisms are considered to be better indicators of health risk than the concentration of the broader fecal coliform group.

Mill Creek (VAT-G10E-03) was initially listed as impaired on Virginia's 2002 303(d) Report on Impaired Waters due to exceedances of Virginia's water quality standard for fecal coliform. Mill Creek is currently listed as not supporting the Recreation Use on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report (VADEQ, 2006) due to water quality violations of the enterococci standard.

Powhatan Creek has two segments that have been identified as impaired and do not support the Recreation Use. Segment VAT-G10E-01, the tidal segment of Powhatan Creek, was listed in Virginia's 1998 303(d) TMDL Priority List and Report because of violations of the fecal coliform water quality standard. The tidal segment of Powhatan Creek is listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the enterococci standard.

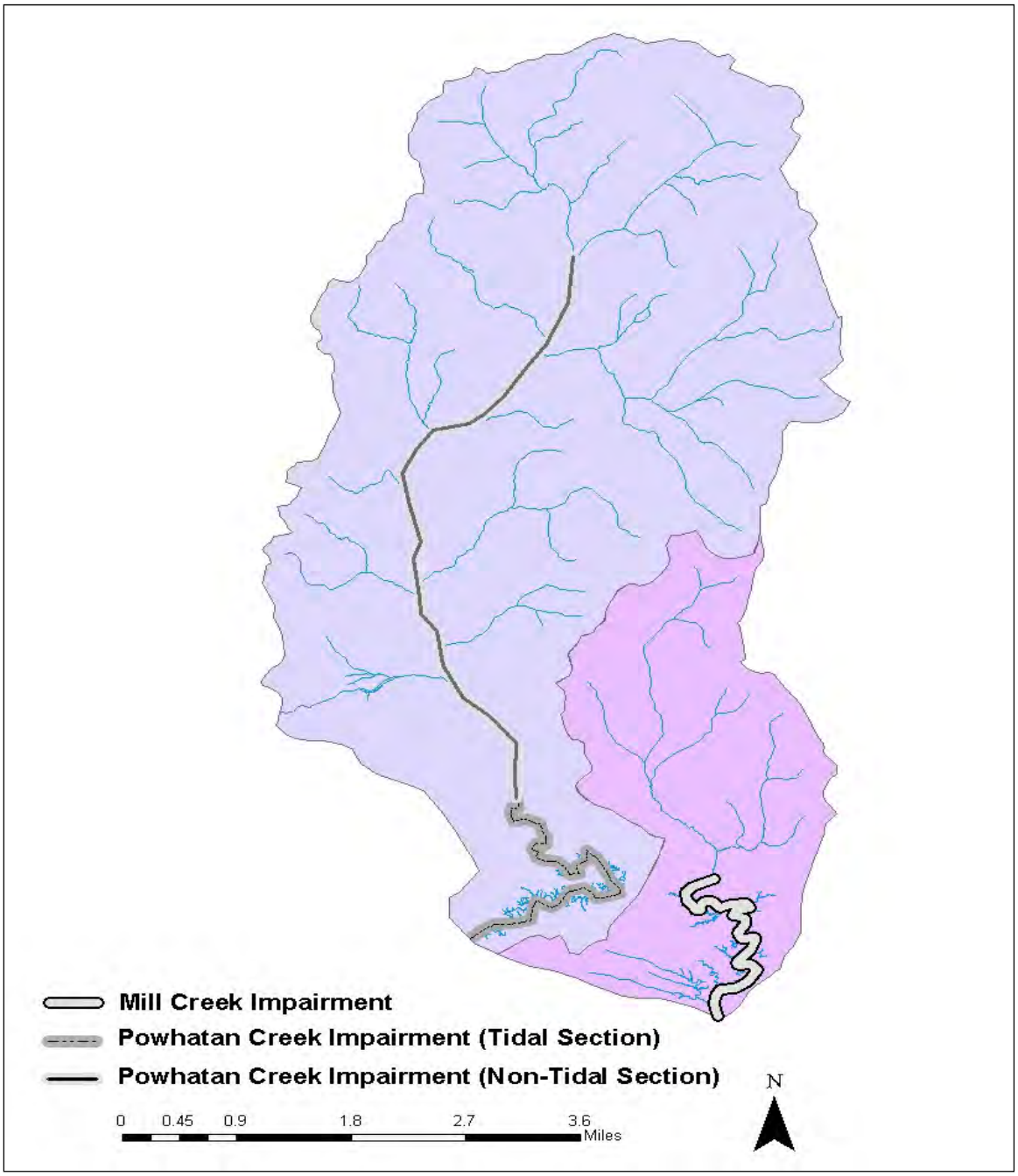
Sufficient exceedances of the fecal coliform bacteria standard in the nontidal segment (VAT-G10R-02) led to a listing in the 2002 305(b)/303(d) Water Quality Assessment Integrated Report. The non-tidal segment of Powhatan Creek is listed as impaired on Virginia's 2006 305(b)/303(d) Water Quality Assessment Integrated Report due to violations of the *E. coli* standard.

A TMDL study for the Mill and Powhatan Creek watersheds, completed in March 2008, examined the watershed characteristics and the sources of bacteria to the creeks. Table 4-2 summarizes the segments for which a TMDL was developed and the associated bacteria indicator and Figure 4-2 illustrates the impaired segments. Using monitoring data, watershed models, and bacterial source tracking (BST), DEQ assigned maximum allowable loads to each source in the watersheds in order to bring Mill and Powhatan Creeks into compliance with the standard for primary contact recreation.

Table 4-2: Mill and Powhatan Creek Impaired Segments

Impaired Segment	Length	Description	Indicator
Powhatan Creek (tidal segment) VAT-G10E-01	0.20 miles	Segment begins at the estuarine/riverine transition and extends to the confluence with James River.	Enterococci
Powhatan Creek (non-tidal segment) VAT-G10R-02	4.85 miles	Segment extends from the confluence with Long Hill Swamp downstream to the estuarine/riverine transition.	E. coli
Mill Creek VAT-G10E-03	1.2 miles	Segment begins at end of tidal influence and extends to the confluence with James River.	Enterococci

Figure 4-2: Impaired Segments in the Mill and Powhatan Watersheds (DEQ 2008)



4.3 Description of Water Quality Monitoring

VADEQ monitors water quality at one station in Mill Creek and two stations in Powhatan Creek. The locations of the monitoring stations used in the TMDL are shown in Figure 4-3 and Table 4-3. Details for fecal coliform data collected at each station are given in Table 4-5. Sufficiently long periods of record are available at each station for use in assessing characteristics of the pollutant loads, such as seasonality, and for calibration of the model.

The bacteria source characterization of the Mill Creek and Powhatan Creek watersheds show a potential for bacteria contributions from agriculture, wildlife, and urban sources. The exceedance rates for the stations causing the impairment listings for these watersheds are given in Table 4-4. As a consequence of these exceedances, Mill Creek and Powhatan Creek were assessed as not supporting the Primary Contact Recreational Use Goal for the 2006 305(b) report and were included on the 2006 303(d) list (VADEQ, 2008).

Table 4-3: Location of DEQ Water Quality Monitoring Stations

Station ID	Station Description	Stream Name
2-MIC000.03 (tidal)	Colonial Parkway Bridge	Mill Creek
2-POW000.60 (tidal)	Colonial Parkway Bridge	Powhatan Creek
2-POW006.77 (non-tidal)	State Route 613 Bridge	Powhatan Creek

Table 4-4: Bacteria Standard Exceedances During the 2004 Assessment Period (2000-2004)

Station ID	Exceedances of Interim Fecal Coliform Standard
2-MIC000.03	11 of 38 (29%)
2-POW000.60	9 of 38 (24%)
2-POW006.77	4 of 38 (11%)

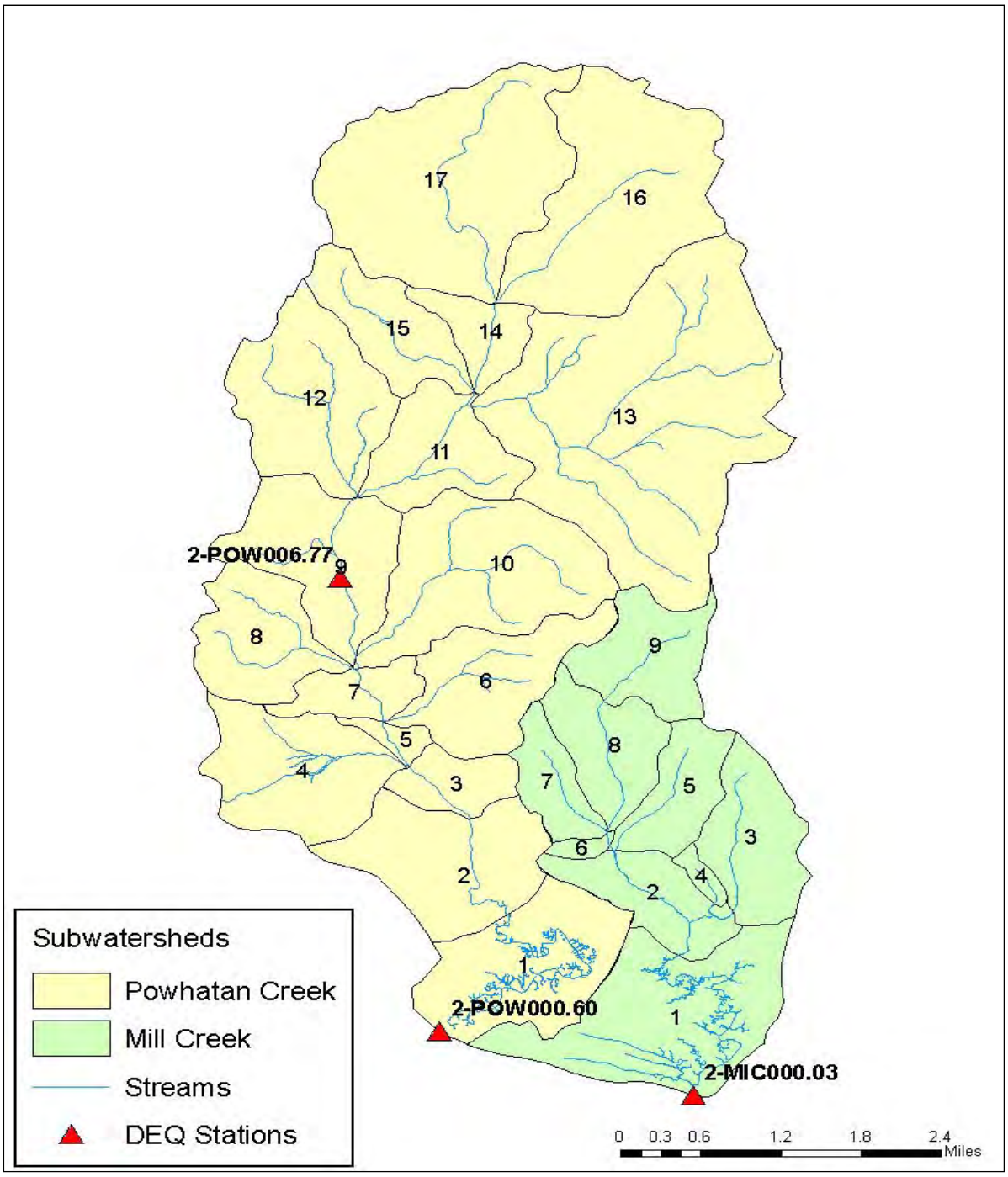
Table 4-5: Summary of Water Quality Data Considered in the TMDL Study

Station ID	Sample Date†		No. of Samples	Sample Value (cfu/100 mL)			Exceedances of Single Sample Standard	
	First	Last		Min	Max	Avg	No	. %
2-MIC000.03	7/14/92	1/5/06	134	2	2400*	373	32	24
2-POW000.60	11/5/92	1/5/06	131	8	1600*	359	31	24
2-POW006.77	1/16/95	5/12/05	88	25	3200*	252	13	15

*Capped value

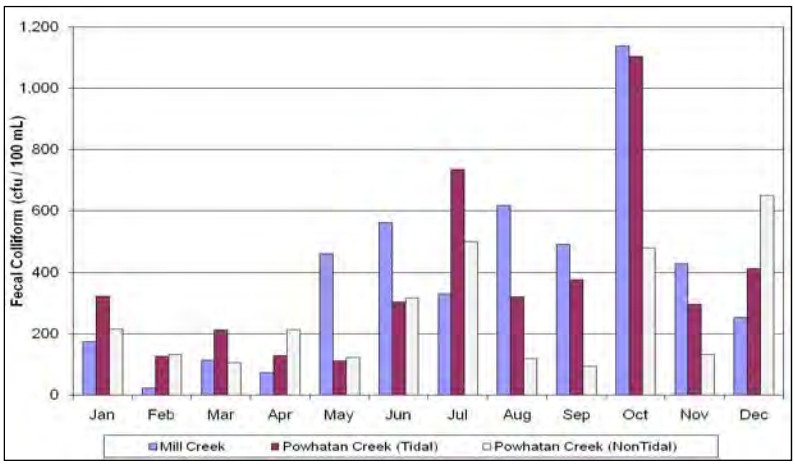
†As of January 2007

Figure 4-3: Water Quality Monitoring Stations Maintained by DEQ



Seasonality of fecal coliform concentrations in the streams was evaluated by plotting the mean monthly fecal coliform concentrations observed at the listing stations (Figure 4-4). Mean monthly fecal coliform concentration was calculated as the mean of all values in any given month for the period of record. The period of record for each station is listed in Table 4-5. A seasonal trend is apparent for both Mill Creek and Powhatan Creek with lower concentrations occurring during the winter and spring and higher concentrations in the summer and fall.

Figure 4-4: Seasonality of Fecal Coliform Concentrations (DEQ 2008)



4.4 Description of Water Quality Modeling

TMDL development requires the use of a watershed-based model that integrates both point and nonpoint sources and simulates in-stream water quality processes. The Hydrologic Simulation Program – FORTRAN (HSPF) version 12 (Bicknell *et al.*, 2001; Duda *et al.*, 2001) was used to model fecal coliform transport and fate in the Mill Creek and Powhatan Creek watersheds. The presence of a tidal zone within the impaired reaches for both Mill and Powhatan Creeks required the addition of a tidal model to accurately model tidal fluxes in the tidal zones. A Tidal PRISM water quality model for small coastal basins and tidal creeks (Kuo and Park, 1994) was used to model fecal coliform transport and fate in the tidal zones.

The HSPF model simulates nonpoint source runoff and pollutant loadings, performs flow routing through streams, and simulates in-stream water quality. HSPF estimates runoff from both pervious and impervious surfaces in the watershed and stream flow in the channel network.

The water quality calibration of both the HSPF and Tidal PRISM models was accomplished using water quality data collected in each watershed. Data from monitoring station 2-POW006.77 was used to calibrate HSPF for the nontidal portion of Powhatan Creek. Because no monitoring data was available for the non-tidal portion of Mill Creek, the calibrated HSPF water quality parameters for the Powhatan Creek were used for simulations of the non-tidal section of Mill Creek. Data from two stations located in the tidal portions of Powhatan (2- 7 POW000.60) and Mill Creek (2-MIC000.03) were used for the Tidal PRISM calibration.

Additional details on the input data used for the modeling and the calibration process can be found in the 2008 TMDL Study.

4.5 Description of Sources Considered

Fecal coliform sources in the Mill Creek and Powhatan Creek watersheds were characterized using data and anecdotal information from the following: Virginia DEQ, Virginia Department of Conservation and Recreation (DCR), Virginia Department of Game and Inland Fisheries (DGIF), Virginia Department of Agricultural and Consumer Services (VDACS), Virginia Department of Health (VDH), public participation, watershed reconnaissance and monitoring, published information, and professional judgment. Point sources and nonpoint sources of fecal coliform are discussed below and described in detail in the TMDL report. In an effort to adequately represent the historic condition of the watershed, changes to some fecal coliform source populations were made for existing conditions and future conditions.

4.5.1 Point Source Contributions

There were four point sources permitted to discharge fecal coliform bacteria in the Mill Creek and Powhatan Creek watersheds. These permitted discharges were for the Municipal Separate Storm Sewer System (MS4) permits for James City County, the City of Williamsburg, Eastern State Hospital, and the College of William and Mary. For this study, the load generated from the College of William and Mary MS4 was aggregated with Williamsburg; Eastern State Hospital MS4 was aggregated with James City County. Although the MS4 conveys runoff from precipitation events, it is considered a point source. The permit allows for the collection and discharge of urban stormwater runoff into a waterbody. Methods to reduce the pollutant load from the MS4s will be included in the next general permit cycle.

4.5.2 Non-Point Source Contributions

Sources of nonpoint source bacteria pollution within the watersheds include livestock, wildlife, pets, and humans. Analysis indicates that significant bacteria loads come from wildlife directly depositing feces in the stream. Wildlife also contribute to loads on land surfaces in accordance with the habitat range for each species. Livestock directly depositing bacteria on the land surface also contribute a significant amount of bacteria to the stream during large storm events. Pets contribute to bacteria loads from the land surface, primarily from residential areas. The amounts of bacteria produced by these nonpoint sources were estimated on a monthly basis to account for seasonal variability in wildlife behavior and livestock production and practices. Table 4-6 summarizes the bacteria produced as a function of where the bacteria are deposited (DEQ 2008).

Table 4-6: Modeled Relative Contribution of Non Point Sources of Bacteria

	Percent of Total	
Source	**Mill**	**Powhatan**
Direct loading to streams		
Wildlife in stream	3	<1
Loading to land surfaces		
Cropland	<1	<1
Pasture	18	3
Residential	73	96
Forest	6	<1

4.6 TMDL Load Reductions and Allocation Results

The Total Maximum Daily Load or total allowable load for a waterbody is composed of a waste load allocation (WLA), load allocation (LA), and margin of safety (MOS).

Total Allowable Load = Waste Load Allocation (WLA) + 5%MOS + Load Allocation (LA)

Total Allowable loads were calculated by multiplying the applicable bacteria criteria by the volume of water. Receiving water volumes were calculated using 1-meter depth profiles from the National Elevation Dataset (NED). The waste load allocation portion of this load refers to the portion of the pollutant load that is delivered to the waterbody from wastewater treatment plants or storm water management systems. In a system like Mill Creek and Powhatan Creek where there are no point source discharges from wastewater treatment plants, the WLA is approximate. It can be, and was, equated to the water that can be expected to be delivered to the waterbody through the stormwater management system. The stormwater management system is designed to collect water from the developed areas of the watershed, so the portion of the total load allocated as the waste load can be equated to the average amount of impervious area within the watershed. Table 4-7 summarizes the total allowable loads for Mill Creek and Powhatan Creek.

Table 4-7: Total Load Allocations and Percent Reductions for Mill and Powhatan Creeks (DEQ 2008)

Waterbody	Source	ΣWLA	ΣLA	MOS*	TMDL
Non-tidal Powhatan Creek	Non point Sources		236×10^{12}		
	Future Load	2.4×10^{12} (1% of LA)			
	James City County (VAR040037 & VAR040076)	15×10^{12}			
	City of Williamsburg (VAR040027 &VAR040039)	0.4×10^{12}			
	Total	17.8×10^{12}	$236x\ 10^{12}$		253.8×10^{12}
Tidal Powhatan Creek	Source	ΣWLA	ΣLA	MOS*	TMDL
	Non point Sources		14 x 1012		
	Future Load	0.14×10^{12} (1% of LA)			
	James City County (VAR040037 & VAR040076)	6.9×10^{12}			
	City of Williamsburg (VAR040027 &VAR040039)	0.2 x 1012			
	Total	7.24×10^{12}	$14x\ 10^{12}$		21.24×10^{12}
Mill Creek	Source	ΣWLA	ΣLA	MOS*	TMDL
	Non point Sources		60 x 1012		
	Future Load	6×10^{11} (1% of LA)			
	James City County (VAR040037 & VAR040076)	3×10^{12}			
	City of Williamsburg (VAR040027 &VAR040039)	0.03×10^{12}			
	Total	3.63×10^{12}	60×10^{12}		63.63×10^{12}
*Implicit MOS					

5.0 ADDITIONAL INFORMATION SINCE TMDL DEVELOPMENT

Since the development of the Mill and Powhatan TMDL Study in 2008, additional data has been collected that can aid the understanding of water quality dynamics within the watershed.

5.1 Land use Changes

An assessment of James City County land use data shows that as of 2007, development in the Powhatan Creek watershed had continued to the degree that 14.4% of the watershed is considered impervious. This number is expected to reach 18.8% once the watershed is fully built out. An assessment of 2009 data shows that 21% of the Mill Creek watershed is impervious. Once the few remaining portions of the watershed are fully developed, this number is expected to reach 23.5%

5.2 Sanitary Sewer System Improvements

Several sewer system improvements have been implemented in the Powhatan Creek watershed by the James City Service Authority (JCSA) since the completion of the TMDL.

- Sewer pipe was slip-lined with HDPE pipe from lift station 1-1 to 1-2 at a cost of $1,000,000. This successfully reduced inflow/infiltration to the point that a sanitary sewer evaluation survey (SSES) in this area is not necessary.
- Crushed pipe in the Fords Colony area was repaired removing a partial blockage and restoring normal function to the system in that area.

5.3 2008 Water Quality Assessment

The 2008 Integrated Report summarized water quality conditions in Virginia from January 1, 2001, to December 31, 2006. The non tidal segment of Powhatan Creek (VAT-G10R-02) was not listed as impaired during this assessment cycle. Additional monitoring demonstrated that the segment upstream of station 2-POW006.77 was fully supporting Water Quality Standards.

5.4 JCC Coliscan Easygel Monitoring

In order to gather additional information about the distribution of bacteria sources in the watersheds, the James City County Stormwater Division, with assistance from the VDEQ, began monitoring for indicator bacteria in April 2009 using the Coliscan Easygel method from Micrology Laboratories. The Coliscan Easygel method measures total coliforms and *E. coli.* The process involves adding a water sample to a liquid medium, pouring the combined sample and medium onto a treated petri dish and then incubating for a specified period of time. The results are then "read" by counting the number of bacteria colonies. VDEQ included the Coliscan Easygel method in the *Virginia Citizen Water Quality Monitoring Program Methods Manual*, October 2007, as an acceptable tool for screening purposes. Monitoring is underway at seven sites on Powhatan Creek and five in Mill Creek. Data is collected on a monthly basis, on an ebb tide.

Results from the tests have varied with a few notable areas of concern. There are some locations that show elevated bacteria levels from time to time, with little pattern, and trends are difficult to distinguish with this small amount of data. Generally, the Mill Creek area looks like an overall bigger concern with regard to bacterial loading.

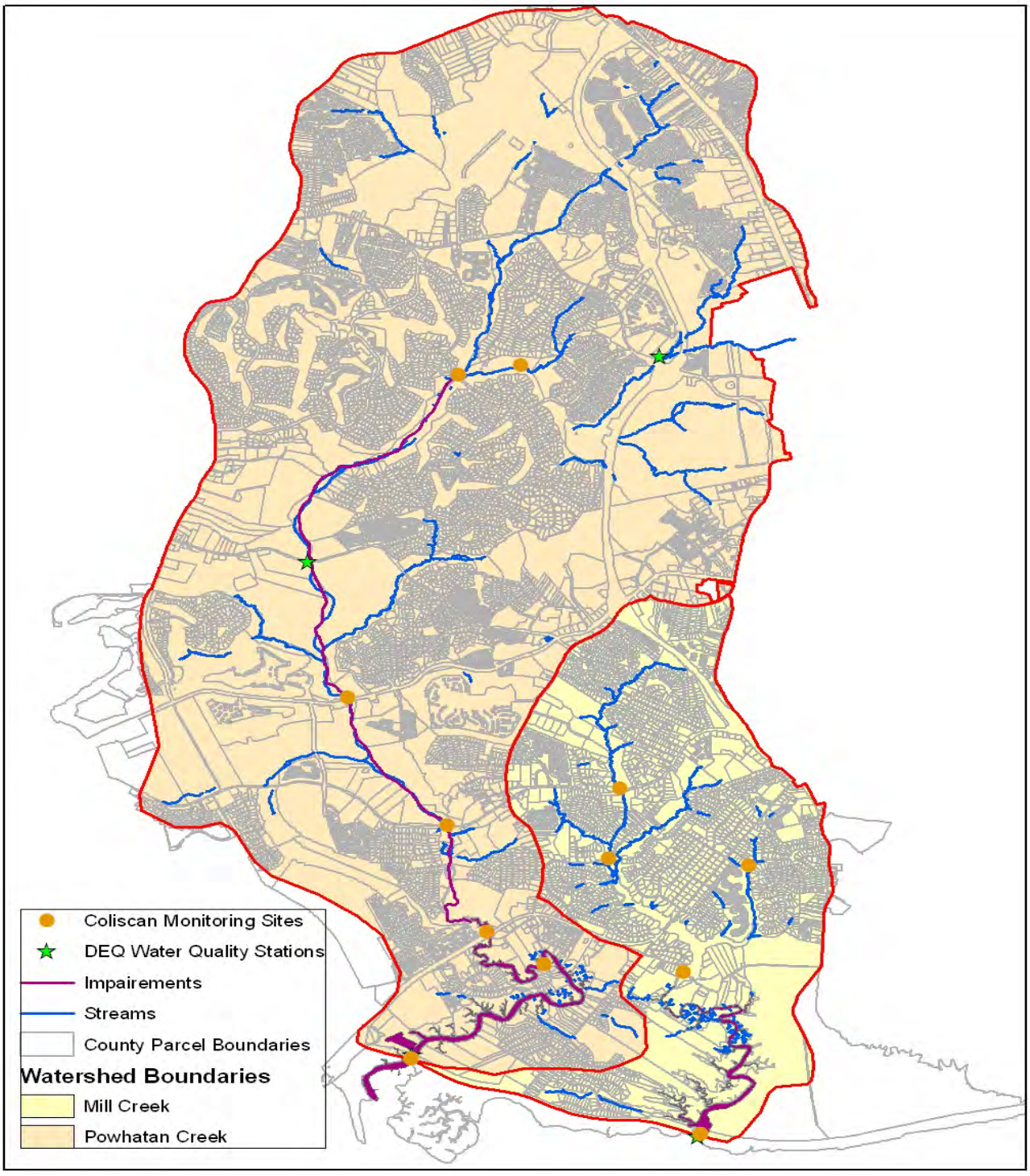
Areas of significance include the eastern branch of Mill Creek, generally east of Jamestown Road and upstream from the Lake Powell wetland. Repeated high counts from that site have fostered further investigation into the area. Other sites are large flood plain areas, likely inhabited by wildlife.

Table 5-1: James City County Coliscan Monitoring

Waterbody	Site	Description of site	Total *E. coli* *	Total *E. coli* *	Total *E. coli* *	Total *E. coli* *	Total E. coli*	Total *E. coli* *	Total *E. coli* *	Total *E. coli* *	Total E. coli *	Total E. coli *	Total E. coli *
			4/13/09	5/13/09	6/17/09	7/15/09	8/12/09	9/14/09	10/12/09	11/10/09	12/11/09	1/26/10	2/23/10
Mill Creek	MCA	Colonial Parkway	50	50	150	0	100	0	800	50	700	50	0
Mill Creek	MCB	Lake Powell Dam Rd	0	0	50	0	200	150	600	100	450	650	50
Mill Creek	MCC	end of Canham Rd	200	600	600	2650	700	3200	450	1050	400	450	150
Mill Creek	MCD	bridge @ Hickory Signpost Rd	100	50	700	1050	250	450	350	100	0	350	400
Mill Creek	MCE	Rte 5	50	100	1900	950	400	600	100	50	100	300	200
Powhatan Creek	PCA	Chisel Run at Edinburgh	0	0	0	50	150	50	550	0	100	50	100
Powhatan Creek	PCB	Powhatan main stem at Edinburgh	0	50	200	300	350	150	1450	0	150	100	300
Powhatan Creek	PCC	Colonial Parkway	50	50	0	50	0	0	100	50	200	100	0
Powhatan Creek	PCD	main stem at Jamestown Rd	200	150	200	150	450	200	450	100	100	50	50
Powhatan Creek	PCE	Monticello Bridge	0	0	0	50	650	0	100	0	0	100	0
Powhatan Creek	PCF	Rte 5		0	50	50	0	0	100	0	100	100	0
Powhatan Creek	PCG	Landfall at Jamestown		0	50	50	150	100	300	150	100	50	0

*The numbers in the spreadsheet are recorded as the number of E.Coli cells/100 ml.

Figure 5-1: Map of Coliscan Monitoring Stations



6.0 PUBLIC PARTICIPATION

An essential step in implementing a TMDL is the input from a broad range of individuals, agencies, organizations and businesses because of their interest and familiarity with local water quality needs and conditions. Public participation facilitates dialogue between local stakeholders and government agencies to commit resources to TMDL implementation, such as funding and technical support. Community members are best suited to identify and resolve sources of water quality problems. In order to engage the public in the development of the TMDL Implementation Plan for the Mill Creek and Powhatan Creek Watersheds, two public meetings were held on June 18, 2009 and May 13, 2010. James City County, State agencies, and community groups are pursuing a number of activities independently of the TMDL Implementation Plan Process. Where appropriate, these initiatives were incorporated into the TMDL Implementation Plan process.

A work group was established to guide development of the TMDL Implementation Plan. The work group met approximately on a monthly basis to review background materials and draft elements of the implementation plan. A list of meeting dates and the number of attendees can be found in Table 6-1. The work group was composed of representatives of County departments, local advocacy groups, and state agencies.

- Friends of the Powhatan Creek Watershed
- James City County Concerned Citizens
- James City County – Environmental Division, Stormwater Division
- James City County Service Authority
- Hampton Roads Planning District Commission
- Virginia Department of Environmental Quality
- Virginia Department of Conservation and Recreation
- Virginia Department of Health

Because of the well informed citizen groups in these watersheds, this work group was able to function as the technical advisory committee for the development of the Implementation Plan. Given the small size of the Mill and Powhatan Creek watersheds, there was not a need to form additional working groups.

Table 6-1: Technical Advisory Group Meetings

Technical Advisory Meeting Date	Number of Attendees
May 5, 2009	11
June 9, 2009	8
July 28, 2009	5
December 8, 2009	9
February 9, 2010	8
March 23, 2010	7

7.0 IMPLEMENTATION OPTIONS

Implementation of this TMDL will contribute to the ongoing water quality improvement efforts aimed at restoring water quality in the Chesapeake Bay. In general, reduction strategies will be implemented in a staged process that first addresses sources with the largest impact on water quality. In urban areas, the focus will be on reducing pollution due to sanitary sewer overflows, septic system failures, stormwater runoff and recreational boating. Because both the Mill and Powhatan Creek watersheds are highly urbanized, (agricultural land uses account for less than two percent of the land area), there are no agricultural management practices proposed in this Implementation Plan.

7.1 Linking the TMDL to Implementation

The Mill Creek and Powhatan TMDL was approved by EPA in 2008, but relied largely on data collected prior to 2006. Water quality monitoring of the system has been ongoing and several studies have been undertaken since the completion of the TMDL to better understand the sources of bacteria loading. It is important to consider both the TMDL as well as the additional information obtained since its completion when developing the implementation actions that may improve water quality within the Mill and Powhatan watersheds. It should be noted that due to uncertainty, the allocations contained in the TMDL study should, but may not, result in attainment of the bacteria standard for primary contact recreation in Mill Creek and Powhatan Creek. The success of the management actions proposed in this document will be determined by ambient water quality data rather than attainment of load allocations.

James City County and its partners will utilize an adaptive management approach in the implementation of the management actions described within this report. These management actions discussed in detail in subsequent sections were chosen because it is believed they will have the greatest effect on improving water quality within the Mill Creek and Powhatan Creek Watersheds. As actions are implemented, water quality data are collected, and new information and technology become available, James City County, in consultation with the Commonwealth, will discontinue actions that are deemed ineffective and add actions that may not be included in this report.

7.2 Identifying Implementation Actions

The implementation actions discussed below were developed to reduce human, livestock and pet sources of bacteria loading to Mill Creek and Powhatan Creek. These actions will be implemented in three phases as identified in Table 7-1. Ongoing actions have already been initiated in response to other regulatory programs, but are expected to reduce bacteria loads to the waterbodies. Phase I actions are those that have been recently initiated or will be initiated in the near future in response to the TMDL and are scheduled for completion within five years. Phase II activities are those that are planned for implementation within the next five years but may not have approved funding sources yet. Phase III actions may require regulatory changes, but they may be implemented as necessary if Phase I and Phase II actions do not significantly improve water quality within the study area. If all these actions prove to be insufficient to meet

the water quality criterion for primary contact recreation in all or parts of Mill and Powhatan Creeks, then the designation of these waters may need to be further evaluated.

In order to remove a designated use or establish subcategories of a use, the state must demonstrate 1) that the use is not an existing use, 2) that downstream uses are protected, and 3) that the source of bacterial contamination is natural and uncontrollable by effluent limitations and by implementing cost-effective and reasonable best management practices for non-point source control (9 VAC 25-260-10). This and other information is collected through a special study called a Use Attainability Analysis (UAA). All site-specific criteria or designated use changes must be adopted as amendments to the water quality standards regulations. Watershed stakeholders and EPA will be able to provide comment during this process. Follow-up monitoring, described in Section 8.4, will evaluate if the water quality goals are being met. If water quality standards are not being met, a UAA may be initiated to reflect the presence of naturally high bacteria levels due to uncontrollable sources.

Table 7-1 Management Options for Implementation of Mill and Powhatan Creek TMDL

Management Category	Management Option	Development Phase
Sanitary Sewer Improvements	Implementation of SSES Plan	Ongoing
	Implement schedule of Regional SSO Consent Order	Ongoing
	Participation in HRFOG education program	Ongoing
Septic System Programs	CBPA Septic Tank Pump Out and Inspection Information Program	Ongoing
	Update septic system locations through pump out program	Ongoing
	Field survey to estimate septic system failure rates	Phase I
	Implement procedures to address failing septic systems	Phase I
	Develop an onsite wastewater treatment funding program	Phase II
	Increase enforcement actions for failing systems	Phase III
Stormwater Quality Programs	Enforcement of Illicit Discharge provisions within the Stormwater Management Ordinance	Ongoing
	County rain barrel rebate program	Ongoing
	Private BMP Inspection and Maintenance Programs	Ongoing
	IDDE screening in Mill and Powhatan Creek watersheds	Phase I
	Coliscan Monitoring in Mill and Powhatan Creeks	Phase I
	Participation in Regional Bacteria Source Tracking Study	Phase I
	Estimate Stormwater contribution to bacteria loading	Phase II
	Investigate retrofits for wet ponds that would reduce bacteria	Phase I
	Retrofit wet ponds to reduce bacteria concentrations	Phase II
Boating Programs	Sewer improvements and pumpout facility at County Marina	Phase I
	Expanded Boater Education Program	Phase II
	Investigate No Discharge designation for Powhatan Creek	Phase III
	Examine environmental benefits of No Wake Zones	Phase III
Pet Waste Programs	Participation in HRSTORM regional education program	Ongoing
	County “Scoop the Poop” campaign	Ongoing
	Pet waste collectors in County Parks	Phase I
	Free pet waste stations for neighborhoods	Phase I
	Investigate viability of Pet Waste Ordinance	Phase III
Aquatic Resource Restoration	County Stream Restoration Program	Ongoing
	Add wetlands restoration program	Phase III
	Identify areas for sea grass restoration	Phase III
Land Use Management	Chesapeake Bay Preservation Area Ordinance	Ongoing
	Implementation of Special Stormwater Criteria	Ongoing
	Enforcement JCC Erosion and Sediment Control Ordinance	Ongoing
	Implementation of JCC Guidelines for Design and Construction of Stormwater Management BMPs	Ongoing
	PRIDE Program	Ongoing
	Watershed Plan for Powhatan Creek Watershed	Complete
	Watershed Plan for Mill Creek Watershed	Phase I
	Implement bacteria priority areas in Powhatan Watershed	Phase II
	Local Delegation of VSMP	Phase III
Wildlife Contribution Controls	BMP Buffer Management	Ongoing

7.2.1 Sanitary Sewer System Improvements

The TMDL calls for a 92 percent reduction in bacteria loading from residential sources in the Powhatan Creek watershed and 95 percent in the Mill Creek watershed. Sources of human bacteria loading to these waterways include sanitary sewer overflows (SSOs) and failing septic systems. SSOs occur when sewer pipes become blocked due to roots, grease or sediment, or when the system loses electric power at pump stations.

James City County is currently involved in a regional effort to work with HRSD, thirteen other Hampton Roads localitie, Virginia DEQ, and EPA Region 3 to develop and implement a plan to address SSOs. The County entered into a Consent Order with DEQ in September, 2007 that outlined actions necessary to reduce SSOs. The actions include the development and implementation of a Sanitary Sewer System Evaluation Survey (SSES) and the development and implementation of a Condition Assessment and Rehabilitation Plan.

The SSES has three phases, two of which have been completed. The first phase involved the physical inspection of 100% of the sewer manholes in each SSES basin. The second phase involved the smoke testing of the system to identify leaks and interconnections with the stormwater system. The final phase will involve the closed circuit tv inspection of the sewer lines. All aspects of the SSES need to be complete by 2011. After the SSES is complete, the Condition Assessment and Rehabilitation Plan will be developed, which will contain improvements to the system necessary to correct identified deficiencies. This Plan will be implemented over the next 10 to 15 years.

It is too early in the process to develop a list of projects and priorities that will be completed in the Mill and Powhatan Creek watersheds. However, one project has been identified for completion in the Powhatan Creek watershed. A long section of the interceptor gravity sewer line along the main stem of Powhatan Creek will be lined to reduce structural failures of the pipe, and thereby reduce SSOs. The project is estimated to cost $1,800,000.

7.2.2 Septic System Programs

The other source of human bacteria in residential areas is failing septic systems. Both watersheds are located entirely within the County's Primary Service Areas (PSA). Any new development within the PSA must connect to the sewer if it is available. It is considered available for a subdivision development if the parcel is within 1000 feet of a sewer line and for all other construction, if sewer is within 300 feet, that project will have to connect. So, it is unlikely that any new septic systems will be installed in either watershed.

Concerning existing septic systems, there are approximately 360 systems in the Mill and Powhatan Creek watersheds. The County currently requires an inspection or pump-out of septic systems at least once every five years. A survey of 60 systems in the two watersheds was conducted by the County in late 2009. Based on that survey, less than 1% (1) of the systems had visible problems.

There are currently no plans to extend sewer lines in either the Mill or Powhatan Creek watersheds to reduce the number of septic systems. However, given the relatively few systems present in the watersheds and a fairly small failure rate, it is unlikely that failing septic systems are a major source of bacteria. Increased education and enforcement efforts related to the septic system maintenance requirements can help reduce failing septic system bacteria contributions.

The Virginia Department of Health will follow its standard procedures to address failing septic systems within the Mill and Powhatan watersheds. A complaint or report of a failing septic system is reported to the Virginia Department of Health (VDH). The Health Department contacts the owner of the property to ascertain the validity of the claim. If the drainfield is determined to be failing, the system is analyzed for the cause of failure. The owner of the property is then sent a Notice of Violation letter which states that a violation of the state regulations may be occurring and advises them of a time period in which they need to correct the violation.

Property owners who may have difficulty correcting failing septic systems due to lack of funding may be referred to James City County Community Development or be provided with information for the Betterment Loan Program (Created by Title 32.1-164.1:2 of the Code of Virginia). There is currently a waiting list for this program. If an owner refuses to correct the problem, the Health Department may resort to legal action.

In addition to the Betterment Loan Program, James City County offers an emergency home repair program to address immediate needs such as septic tank pumpouts and system replacements. Similar to the loan program, there are income limits and James City County works with Housing Partnerships, Inc. and other providers to assist those who may not meet the emergency program limits. In James City County, system replacements can typically cost between $6,500 and $7,500. Advanced replacement systems for difficult-to-treat sites can cost as much as $23,000. Grinder pumps often cost over $12,000. Information on this program can be found at http://www.jccegov.com/communityservices/housing-com-dev.html.

In the future, James City County may also consider expansion of the emergency home repair program to provide for the reduction of nitrogen, phosphorus and pathogens being released by continued use of failing septic systems. The program would be designed to assist low-moderate income homeowners with repair/replacement of non-functioning systems with nutrient reducing systems or homeowners whose properties are eligible to install conventional systems but unable to afford repairs without assistance. James City County would work with the Health Department to identify failing septic systems and offer financial assistance to homeowners to assist them in repairing failing systems. It is estimated that grant funding, potentially through the DCR WQIF program, could assist 10-13 homeowners to repair or replace failing systems, with approximately $80,000 over a 2 year period. Additional low interest loans may be available through the Virginia Revolving Loan Program to be blended with grant funds for each project.

7.2.3 Stormwater Quality Programs

The TMDL calls for reductions in bacteria delivered to waterbodies through urban stormwater runoff. Traditional definitions of stormwater have usually characterized it as nonpoint source runoff. However, most urban and industrial stormwater is discharged through conveyances, such as separate storm sewers, ditches, channels or other conveyances, which are considered point sources under the Clean Water Act (CWA), and subject to regulation through the National Pollutant Discharge Elimination System (NPDES) permit program.

Virginia is an authorized state under the federal permitting program. DCR administers the federal program pertaining to the municipal separate storm sewer systems (MS4s) and construction activities as part of the Virginia Stormwater Management Program (VSMP) permit program, which is authorized under the Virginia Stormwater Management Act. As mandated by the Clean Water Act and EPA's Phase 1 (11/16/90) and Phase 2 (12/8/99) stormwater regulations, the federal permitting requirements have been incorporated into the Permit Regulation in sections 4 VAC50-60-380 and 390.

The majority of the Powhatan Creek watershed and the upper half of the Mill Creek watershed are covered by the County's Phase II VSMP permit. The County has implemented or plans to implement the following programs to reduce the bacteria concentrations delivered to the Creeks via stormwater runoff.

7.2.3.1 Coliscan Monitoring

In order to gather additional information about the distribution of bacteria sources in the watersheds, the JCC Stormwater Division, with assistance from the VDEQ, began monitoring for indicator bacteria in April 2009 using the Coliscan Easygel method from Micrology Laboratories. The Coliscan Easygel method measures total coliforms and *E. coli.* The process involves adding a water sample to a liquid medium, pouring the combined sample and medium onto a treated petri dish and then incubating for a specified period of time. The results are then "read" by counting the number of bacteria colonies. VDEQ included the Coliscan Easygel method in Virginia Citizen Water Quality Monitoring Program Methods Manual, October 2007, as an acceptable tool for screening purposes.

Monitoring has been underway since 2009 at seven sites on Powhatan Creek and five in Mill Creek. Data is collected on a monthly basis, on an ebb tide. Going forward JCC Stormwater Division will both continue monitoring existing sites and seek to include additional sites through 2013. Volunteer monitors will be recruited and trained during 2010. Results will be used to identify bacteria management areas for enhanced effort.

7.2.3.2 Wet Pond Retrofits

The Powhatan Creek Stormwater Management Master Plan also identified 24 locations for potential stormwater retrofit sites in the watershed. Some of these potential retrofits include existing or proposed wet ponds. These ponds and others that have been constructed since the study was done need to be investigated for incorporation in the *Bacteria Priority Area*

management option (§7.2.6.3) for possible use in reducing bacteria populations. In addition, the use of aeration systems will be investigated to determine their effectiveness in reducing bacteria populations.

7.2.3.3 Regional Bacteria Source Tracking Study

Many localities within Hampton Roads are faced with the lack of useful bacteria source tracking information provided by Total Maximum Daily Load (TMDL) Studies being developed by DEQ. Stormwater departments throughout the Region experience difficulty in reducing bacteria to impaired waterbodies without sufficient information on the contributing sources, and Utilities departments are being burdened with requests to investigate system deficiencies without reliable evidence. Both departments expressed interest in using reliable methods to determine if bacteria are from a human source. With bacteria TMDLs approved or scheduled for development within all the Hampton Roads localities, locality staff requested additional information on potential bacteria source tracking methodologies.

The Hampton Roads Planning District Commission staff has been leading a regional effort to develop a bacterial identification methodology for the Hampton Roads region. Proven genetic techniques will be used to differentiate bacteria sources at the species level so that TMDL plans can be designed and targeted to address the cause of the bacterial impairment. University researchers will conduct the study, which the Hampton Roads Sanitation District and the following localities have agreed to fund: Isle of Wight, James City County, Norfolk, Portsmouth, Suffolk, Virginia Beach, Williamsburg and York County.

In April 2008 locality staff attended a meeting to hear presentations from leading scientists in the bacteria source tracking field. Dr. Rachel Noble (UNC), Dr. Jody Harwood (USF), and Dr. Charles Hagedorn (VT), provided the attendees with information on the state of the science and the most promising methodologies. Following this meeting, a subcommittee consisting of representatives from the Region's localities and PDC staff was formed to work with the scientists to develop a regional study plan.

The subcommittee considered small watersheds that had completed TMDLs, and selected watersheds that had very high bacteria concentration and/or significant public interest. Three case study sites were selected: Shingle Creek in Suffolk, Moores Creek in York County, and Mill Dam Creek in Virginia Beach. After the Regional Study is complete by the end of 2011, a toolbox of source tracking methodologies will be available to local governments to use in determining if impaired waterbodies are impacted by human sources of bacteria.

7.2.3.4 County Rain barrel Rebate Program

Starting in December 2007, the James City County Service Authority began offering its customers a refund of up to $200 towards the purchase of up to four rain barrels. The purpose of the program was to encourage residents to conserve water used for irrigation and reduce rooftop runoff from residential properties.

7.2.3.5 Phase II General Permit Requirements – Special TMDL Provisions

James City County was issued a new MS4 General Permit for Phase II Stormwater Discharges on July 1, 2008. This permit requires the County to take additional actions to evaluate the stormwater influence on impaired waterbodies with approved TMDLs as of July 1, 2008. The Mill and Powhatan Bacteria TMDL was not approved prior to the effective date of the MS4 permit, so the conditions will not apply in these watersheds until the next permit cycle. However, James City County is already implementing some of the actions ahead of schedule.

7.2.3.5.1 Illicit Discharge Detection and Elimination Program

The operator shall develop and implement outfall reconnaissance procedures to identify potential sources of bacteria from anthropogenic activities. The operator shall perform reconnaissance on all outfalls during the 5-year permit period and shall annually conduct reconnaissance on a minimum of 15% of its known MS4 outfalls discharging to the surface water for which the WLA has been assigned.

7.2.3.5.2 Estimate Stormwater contribution to bacteria loading

The operator shall conduct an annual characterization that estimates the volume of stormwater discharged, in cubic feet and the quantity of pollutant identified in the WLA, in a unit consistent with the WLA, discharged by the regulated small MS4.

7.2.4 Boating Programs

The TMDL called for a 100 percent reduction in bacteria loading from marinas and boats in Powhatan Creek. James City County purchased the Jamestown Yacht Basin in 2006 and began a series of improvements aimed at both user safety and environmental protection. To date the County has:

- eliminated the aging on-site waste disposal system and connected the system to public sewer through a grinder pump and force main
- stabilized the docks to minimize shoreline erosion
- installed new electrical connections for the facility and docks
- upgraded the water supply lines to minimize leaks, conserve water and eliminate on-going erosion along water lines

Installation of a sanitary waste pump-out system was completed in 2010 and the County is considering alternatives to rebuild the fueling docks in order to improve environmental safeguards at the site (Phase I). At this time the facility is leased and operated by a private party. Improvements necessary to meet the Clean Marina Program requirements will be considered during Phase II.

Section 312 of the Clean Water Act requires boats with installed toilets to also have Marine Sanitation Devices (MSDs). Type I and II MSDs are treat and discharge units, while Type III MSDs are holding tanks that must be pumped out at pump out facilities. State law (9 VAC 25-71) prohibits the discharge of raw sewage from boats, holding tanks, or portable toilets. Federal

law prohibits a state from adopting regulations regarding MSDs that are more stringent than federal regulations, but it allows a state to petition EPA for designation of No Discharge Zones (NDZs), where all sewage discharges, treated or untreated, are banned. The state must demonstrate that the particular water body requires special protection and that there are adequate pump out facilities in the area, since boat sewage wastes in NDZs would have to be held until pumped out.

In 2009, Virginia passed HB1774 to amend the § 62.1-44.33 of the Code of Virginia to designate all tidal waters in Virginia as No Discharge Zones. The State is currently developing a prioritization plan for those waterbodies. In the interim, requests for designation must still be made from residents or local governments. James City County will investigate the necessity and feasibility of designating Powhatan Creek as a No Discharge Zone (NDZ).

In order to address shoreline erosion and resuspension of bacteria laden sediment, James City County is studying the feasibility of "No Wake Zones" in Powhatan Creek. The County is also developing an expanded boater education program to provide outreach materials to boaters on ways to reduce their impact on water quality.

7.2.5 Pet Waste Programs

In 2008, recognizing that bacterial impairments were a county-wide problem, James City County initiated a local Scoop-the Poop campaign by placing 15 Dogivalets® in the County park trail system. Of the 15 units, nine are located within the Powhatan Creek watershed. These units dispense pet waste collection bags and provide a safe disposal unit for the bagged waste. Since then, the County has offered similar systems to neighborhoods which agree to undertake the maintenance, prepared a public service announcement (PSA) explaining the use of the Dogivalets® and published information on its webpages. To date, six units have been placed in Powhatan Creek neighborhoods and one unit in a Mill Creek neighborhood. The JCC Stormwater Division has continued to focus on pet owners, participating in the annual Humane Society's Bark-in-the Park fundraiser and developing dog-friendly frisbees with a scoop-the-poop message. HRPDC Scoop-the-Poop campaign materials are extensively utilized. The HRPDC Poop Fairy PSAs air on the County's government and community access channels. In the future, the County may evaluate and consider implementation of a pet waste collection ordinance.

7.2.6 Land Use Management

James City County has several programs that serve to manage development and minimize its environmental impact. Continuation of these programs will serve to protect critical habitats within the Mill and Powhatan watersheds and may be important in reducing the amount of bacteria entering the creek systems.

7.2.6.1 Erosion and Sediment Control

Erosion and sedimentation control measures may indirectly reduce the bacteria loading to waterbodies. Bacteria can cling to small sediments, so erosion prevention measures should

also serve to reduce bacteria loading. The Virginia Department of Conservation and Recreation (DCR) implements the state Erosion and Sediment Control (ESC) Program according to the Virginia Erosion and Sediment Control Law, Regulations, and Certification Regulations (VESCL&R). The law is codified at Title 10.1, Chapter 5, Article 4 of the Code of Virginia, regulations are found at Section 4VAC30-50, and certification regulations are found at Section 4VAC50-50 of the Virginia Administrative Code. The ESC Program's goal is to control soil erosion, sedimentation, and nonagricultural runoff from regulated "land-disturbing activities" to prevent degradation of property and natural resources. The regulations specify "Minimum Standards," which include criteria, techniques and policies that must be followed on all regulated activities. These statutes delineate the rights and responsibilities of governments that administer an ESC program and those of property owners who must comply.

DCR has created the Virginia Erosion and Sediment Control Handbook in order to establish minimum design and implementation standards to control erosion and sedimentation from land-disturbing activities in Virginia. Through the James City County Erosion and Sediment Control Ordinance, all construction in the County must conform to the minimum standards of The Virginia Erosion and Sediment Control Regulations and the Virginia Erosion and Sediment Control Handbook third edition. All construction related activities are to limit land disturbance to the amount necessary to accommodate the desired improvements. Work will be avoided in the tree drip line area and comply with the Virginia Erosion and Sediment Control Handbook with respect to tree preservation and protection. All contractors must have the current edition of the Virginia Erosion and Sediment Control Handbook available on-site.

7.2.6.2 Chesapeake Bay Preservation Ordinance

The Virginia General Assembly adopted the Chesapeake Bay Preservation Act in 1988 and required all localities in Tidewater Virginia to implement local water quality measures by utilizing and developing land in ways that minimize impacts on water quality. James City County responded to this requirement by adopting the state's first Chesapeake Bay Preservation Ordinance (CBPAO) on August 6, 1990. The purpose of the CBPAO is to protect existing high quality waters, prevent an increase in pollution and to restore state waters to a condition that permits all reasonable public uses and supports the growth of healthy aquatic life. This is accomplished by regulating development practices in the watershed. The most highly regulated areas are buffers called Resource Protection Areas (RPAs). RPAs include tidal wetlands, non-tidal wetlands, tidal shores, highly erodible soils, and a vegetated buffer area not less than one hundred feet in width that is adjacent to and landward of these areas. Buffer areas are also located along both sides of any water body with perennial flow. All of the other land in the watershed is labeled as Resource Management Areas, and protects the boundaries of the RPA.

7.2.6.3 Bacteria Priority Areas

The Powhatan Creek Watershed Management Plan dated May, 2002, and its associated Stormwater Management Master Plan identified as a management objective the control of bacteria resulting from development activities in the mainstem areas of the watershed. The

SWM Master Plan recommends that stormwater practices in the tidal portion of the mainstem area be designed to maximize bacteria removal.

For wet ponds and wetland BMPs, these design modifications include: increasing light conditions in the water column, providing a minimum 48 hour detention time for stormwater, designing inlet and outlet structures to prevent re-suspension of bacteria-laden bottom sediments, reducing turf and open areas around ponds to discourage geese and waterfowl populations, and adding shallow benches and wetland areas to enhance the plankton community and increase bacterial predation. For filtering system BMPs, the design modifications include: the use of finer-grained media in the filter bed, extending the detention time for pretreatment chambers, removing sediments from pretreatment areas more frequently, and filters should be oriented to provide maximum solar exposure. For open channel systems, dry swales should be used in place of wet swales, and they should be designed to be self-cleansing or promote maximum sediment retention.

The use of these BMP enhancements needs to be extended to the tidal portion of the Mill Creek watershed as well as the non-tidal portions of both watersheds.

7.2.7 Wildlife Contribution Controls

James City County encourages pond buffers or setbacks to both help filter stormwater and to discourage resident wildlife populations. The County BMP manual provides guidelines on the effective placement and size (width) of buffers. Generally, pond buffers should be at least 25 feet outward from the maximum design high water surface elevation of the pond, usually the 100-year design storm. Forested buffers are particularly desirable adjacent to ponds. Native shrubs and ground covers are recommended in the non-forested areas of the buffer to discourage wildlife. Annual mowing is not required of the pond buffer except in maintenance right-of-ways. In 2011, James City County installed attractive “Do Not Mow Zone” signs along the County-owned BMP pond buffers to lead by example. These signs are evident along walking and biking trails and many sports fields.

7.3 Implementation Costs and Benefits

The primary benefit of the implementation of the management actions described in this IP is the reduction of bacteria levels in Mill Creek and Powhatan Creek. The programs and actions contained within this IP will serve to reduce the anthropogenic sources of bacteria within the Mill Creek and Powhatan Creek Watersheds. However, in addition to and as a result of reducing the amount of bacteria, stakeholders can anticipate benefits within these watersheds that include:

- improved public health
- conservation of natural resources
- improved aquatic life
- improved riparian habitat
- reductions in the amount of flood damage
- improved recreational opportunities
- greater economic opportunities

It is hard to gage the impact that reducing bacterial contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from pollutant sources, through contact with surface waters, should be reduced considerably.

The main objective of this IP is improving water quality in Mill and Powhatan Creeks, but additional benefits may include continued economic vitality and strength. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide the resources and funding necessary to pursue restoration and enhancement activities. The residential and urban implementation actions recommended in this IP may provide economic benefits to the landowner, along with the expected environmental benefits. An ancillary benefit may be enhanced real estate values for farms, homes, and businesses located near water bodies with good water quality.

Because the Mill and Powhatan Creek watersheds are located within the Chesapeake Bay watershed, reducing sediment and nutrients loads as a result of BMPs that are installed to reduce bacteria will help obtain implementation goals in the Chesapeake Bay TMDL.

Additionally, money spent by landowners, government agencies, and non-profit organizations in the process of implementing the IP will stimulate the local economy. The residential programs will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry. In terms of economic benefits to homeowners, an improved understanding of private sewage systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership (DCR 2003).

Because many of the programs mentioned in this report also serve purposes other than to reduce bacteria, and they may cover areas larger than the Mill and Powhatan Watersheds, the costs of reducing bacteria levels can be difficult to estimate. Estimated costs for proposed management actions and programs are outlined in Table 7-3. The estimated costs for programs such as stormwater management and sanitary sewer system improvements are estimated for the Mill and Powhatan Watersheds from the County-wide annual budgets for these programs.

Table 7-2: Estimated Costs of Management Options

Management Category	Management Option	Estimated Initial Costs[1,2]	Estimated Maintenance Costs[1,2]
Sanitary Sewer Improvements	Implement schedule of Regional SSO Consent Order	$4,095,842	$3 million*
	Participation in HRFOG education program	Ongoing	$7,500
Septic System Programs	CBPA Septic Tank Pump Out and Inspection Information Program	Ongoing	$4,000
	Update septic system locations through pump out program	Ongoing	$20,000
	Field survey to estimate septic system failure rates	$10,000	$20,000
	Implement procedures to address failing septic systems	Ongoing	$20,000
	Develop an onsite wastewater treatment funding program	$20,000	$80,000
	Increase enforcement actions for failing systems	$10,000	$40,000
Stormwater Quality Programs	Enforcement of Illicit Discharge provisions within the Stormwater Management Ordinance	Ongoing	$25,000
	County rain barrel rebate program	Ongoing	$10,500
	Private BMP Inspection and Maintenance Programs	Ongoing	$100,000
	IDDE screening in Mill and Powhatan Creek watersheds	Ongoing	$20,000
	Coliscan Monitoring in Mill and Powhatan Creeks	Ongoing	$12,000
	Participation in Regional Bacteria Source Tracking Study	Ongoing	$25,000
	Estimate Stormwater contribution to bacteria loading	$10,000	$2,000
	Investigate retrofits for wet ponds that would reduce bacteria	$5,000	0
	Retrofit wet ponds to reduce bacteria concentrations	$100,000	$4,160,000
Boating Programs	Sewer improvements and pumpout facility at County Marina	$40,000	$20,000
	Expanded Boater Education Program	$5,000	$5,000
	Investigate No Discharge designation for Powhatan Creek	$5,000	0
	Examine environmental benefits of No Wake Zones	$5,000	0
Pet Waste Programs	Participation in HRSTORM regional education program	$7,500	$7,500
	County “Scoop the Poop” campaign	$5,000	$2000
	Pet waste collectors in County Parks	Ongoing	$2,500
	Free pet waste stations for neighborhoods	$2,500	$250
	Investigate viability of Pet Waste Ordinance	$5,000	0
Aquatic Resource	County Stream Restoration Program	$3,000,000	$300,000
	Add wetlands restoration program	$25,000	$150,000
	Identify areas for sea grass restoration	$25,000	0
Land Use Management	Chesapeake Bay Preservation Area Ordinance	Ongoing	$340,000
	Implementation of Special Stormwater Criteria	Ongoing	
	Enforcement JCC Erosion and Sediment Control Ordinance	Ongoing	
	Implementation of JCC Guidelines for Design and Construction of	Ongoing	
	PRIDE Program	Ongoing	
	Watershed Plan for Powhatan Creek Watershed	Ongoing	
	Watershed Plan for Mill Creek Watershed	$150,000	
	Implement bacteria priority areas in Powhatan Watershed	$10,000	
	Special stormwater criteria for Mill Creek Watershed	10,000	
	Local Delegation of VSMP	TBD	
Wildlife Contribution Controls	BMP Buffer Management	Ongoing	See above

[1] Overall estimates available for broad categories only, based on estimated funding availability, subject to County Board of Supervisors approvals, budget appropriations, grants received, State funding appropriations, and Federal funding appropriations, coupled with known costs for current specific programs and maintenance requirements.

[2] Cost assumptions: 1full time equivalent (FTE) = $100K including fringe, vehicle, office space, equipment, etc.

*Total estimated expenditure over the next 10-15 years.

8.0 MEASURABLE GOALS AND MILESTONES

8.1 Establishing Goals

8.1.1 TMDL Goals

- Reduce fecal bacteria load in order to meet the Total Maximum Daily Load and established water quality standards to the maximum extent economically achievable.

8.1.2 Related Watershed Management Goals

- Restore water quality to the level necessary to support primary contact recreation

8.2 Establishing a Timeline and Milestones for Implementation

As described in previous sections, the actions proposed in this Implementation Plan will be implemented in phases. A schedule of Phase I activities is contained in Table 8-1, and Phase II and III actions will be implemented as actions prove necessary and funding becomes available. The completion of management actions will be tracked in program annual reports. Management actions related to stormwater management will be reported in James City County's MS4 annual report.

Progress towards meeting water quality goals will be tracked through the completion of the 305(b)/303(d) Water Quality Assessment Integrated Report submitted by the Virginia DEQ to EPA every even numbered year. This report is a summary of the water quality conditions for the five year assessment period preceding the report, and serves as the State's list of impaired waters. If the waters within the Mill and Powhatan Creek watersheds remain listed as impaired for bacteria after 2020, then James City County, in cooperation with the stakeholders listed in this report, will reevaluate the causes of impairment to these waters.

Table 8-1 Timeline for Phase I and Ongoing Management Actions

Management Category	Management Option	Projected Start Date	Projected Completion Date
Sanitary Sewer Improvements	Implementation of SSES Plan	ongoing	Nov 2011
	Implement schedule of Regional SSO Consent Order	ongoing	2013
	Participation in HRFOG education program	ongoing	ongoing
Septic System Programs	CBPA Septic Tank Pump Out and Inspection Information	ongoing	Ongoing
	Update septic system locations through pump out program	ongoing	ongoing
	Field survey to estimate septic system failure rates		
	Implement procedures to address failing septic systems		
Stormwater QualityPrograms	Enforcement of Illicit Discharge provisions within the Stormwater Management Ordinance	ongoing	ongoing
	County rain barrel rebate program	ongoing	Dec 2015
	Private BMP Inspection and Maintenance Programs	ongoing	ongoing
	IDDE screening in Mill and Powhatan Creek watersheds	ongoing	June 2013
	Coliscan Monitoring in Mill and Powhatan Creeks	ongoing	ongoing
	Participation in Regional Bacteria Source Tracking Study	ongoing	Jan 2012
Boating Programs	Sewer improvements and pumpout facility at County Marina	ongoing	Dec 2010
Pet Waste Programs	Participation in HRSTORM regional education program	ongoing	ongoing
	County “Scoop the Poop” campaign	ongoing	ongoing
	Pet waste collectors in County Parks	ongoing	ongoing
	Free pet waste stations for neighborhoods	ongoing	June 2013
Aquatic Resource Restoration	County Stream Restoration Program	ongoing	ongoing
Land Use Management	Chesapeake Bay Preservation Area Ordinance	ongoing	ongoing
	Implementation of Special Stormwater Criteria	ongoing	ongoing
	Enforcement JCC Erosion and Sediment Control Ordinance	ongoing	ongoing
	Implementation of JCC Guidelines for Design and Construction of Stormwater Management BMPs	ongoing	ongoing
	PRIDE Program	ongoing	ongoing
	Watershed Plan for Powhatan Creek Watershed	ongoing	complete
	Watershed Plan for Mill Creek Watershed	ongoing	2011
	Implement bacteria priority areas in Powhatan Watershed	ongoing	ongoing
Wildlife Contribution Controls	BMP Buffer Management	ongoing	ongoing

8.3 Developing Tracking and Monitoring Plans

James City County will continue monitoring water quality and measuring the effectiveness of management actions through its coliscan monitoring program. Going forward JCC Stormwater Division will both continue monitoring existing sites and seek to include additional sites through 2013. Volunteer monitors will be recruited and trained during 2010. Results will be used to identify bacteria management areas for enhanced effort. James City County will report on Stormwater related management programs through its MS4 Permit Annual Report. Ultimately, the determination of whether Mill Creek and Powhatan are impaired or meeting water quality standards is determined by water quality monitoring conducted by DEQ at the established stations in Mill Creek and Powhatan Creek (2-POW006.77, 2-POW003.38, 2-POW000.60, and 2-MIC000.03).

9.0 STAKEHOLDERS ROLES AND RESPONSIBILITIES

The management actions described in this report will be implemented by federal, state, regional and local agencies and non-governmental organizations in a collaborative effort to achieve the primary goal of reducing fecal coliform concentrations within the Mill Creek and Powhatan Creek Watersheds. The following section describes the agencies involved in the development of this Implementation Plan. Table 9-1 summarizes the roles and responsibilities of each agency by indicating which management actions each agency is responsible for.

9.1 Federal

9.1.1 United States Environmental Protection Agency

Section 303(d) of the Clean Water Act and EPA's Water Quality Planning and Management Regulations (40 CFR Part 130) require states to develop Total Maximum Daily Loads (TMDLs) for water bodies which are exceeding water quality standards. The EPA has the regulatory authority to approve TMDLs. Section 303(d) of the CWA and current EPA regulations do not require the development of implementation strategies. The EPA will review the Mill Creek and Powhatan Creek TMDL Implementation Plan for completeness.

9.2 State

9.2.1 Department of Environmental Quality (DEQ)

The State Water Control Law authorizes the State Water Control Board to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the swimming, fishing, shell fishing, aquatic life, and drinking water uses. For many years the focus of DEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of DEQ's pollution reduction efforts from the effluent of wastewater treatment plants to the pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs.

The DEQ is the lead agency in the TMDL process. The Code of Virginia directs DEQ to develop a list of impaired waters (303 (d) list), develop TMDLs for these waters, and develop Implementation Plans for the TMDLs. DEQ administers the TMDL process including the public participation component and formally submits the TMDLs to EPA and the State Water Control Board for review and approval.

Additionally, §303(e) of the Clean Water Act and EPA's water quality management regulation 40 CFR 130.5 require the State to develop Water Quality Management Plans (WQMP) for the major watersheds. The purpose of the WQMPs is to present the processes to be used in the watershed for attaining and maintaining water quality standards. Also, the WQMPs serve as the repository for all TMDLs and TMDL Implementation Plans developed within the watershed. DEQ, with the assistance of DCR, the Department of Mines, Minerals and Energy (DMME), and

VDH plans to update the State's 303(e) WQMPs concurrently with the TMDL development effort.

DEQ provided partial funding for the development of this Implementation Plan. DEQ staff attended technical advisory committee meetings, presented information to the TAC on no discharge zones, and assisted in the publication of the public meetings.

9.2.2 Department of Conservation and Recreation (DCR)

DCR is authorized to administer Virginia's nonpoint source pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. EPA is requiring that much of the §319 grant monies be used for the development of TMDLs.

Because of the magnitude of the nonpoint source component in the TMDL process, DCR is a major participant in the TMDL process. DEQ and DCR have signed a Memorandum of Understanding agreeing to a cooperative effort in the TMDL process including Implementation Plan development. Specifically, DCR agreed to assume responsibility for the nonpoint source component of all TMDLs including the final allocations, with the exception of mineral extraction. This includes those TMDLs contracted by DEQ. Also, DCR agreed to present the nonpoint source component of the TMDLs in the public forums. Another major role DCR has in the TMDL process is the awarding and managing of the contractual services for the development of TMDLs related to nonpoint sources.

DCR staff attended technical advisory committee meetings and provided input on management options related to septic systems and pet waste controls.

9.2.3 Virginia Department of Health (VDH)

The Divisions of Onsite Sewage, Water Services, Environmental Engineering, and Marina Programs are responsible for effectively adopting and implementing regulations for marinas, private wells, and onsite wastewater treatment and disposal. The divisions provide guidance, training, technical assistance, grant and administrative support to over 300 field staff. The divisions foster and maintain communication with the onsite community made up of contractors, engineers, soil scientists, pumpers, academics, manufacturers, builders, real estate agents, and most especially, homeowners.

The mission of the Division of Onsite Sewage Services is to protect public health and ground water quality. This is best achieved by implementing an onsite wastewater program based on sound scientific, engineering, and public health principles. The Division strives to maintain effective communication in the onsite community.

On July 1, 2009, the Virginia Department of Health began regulating the operation and maintenance of alternative onsite sewage systems. Interim requirements, such as requiring owners of newly installed alternative systems to record notices in the land records and for owners to operate their alternative systems according to manufacturers' instructions, took

effect on July 1. Other requirements regarding alternative systems are under development and will be phased in as emergency regulations and final regulations go into effect.

VDH staff attended technical advisory committee meetings and played an integral role in determining that failing septic systems are not the primary source of bacteria to Mill and Powhatan Creeks. Staff assisted the County in conducting additional sanitary surveys throughout the watershed.

9.3 Regional

9.3.1 Hampton Roads Planning District Commission

Planning District Commissions are voluntary associations that were created in 1969 pursuant to the Virginia Area Development Act and a regionally executed Charter Agreement. The purpose of planning district commissions, as set out in the Code of Virginia, Section 15.2-4207 is "…to encourage and facilitate local government cooperation and state-local cooperation in addressing on a regional basis problems of greater than local significance."

The Hampton Roads Planning District Commission (HRPDC), one of 21 Planning District Commissions in the Commonwealth of Virginia, is a regional organization comprised of this area's sixteen local governments. The HRPDC was formed in 1990 by the merger of the Southeastern Virginia Planning District Commission and the Peninsula Planning District Commission. The HRPDC serves as a resource of technical expertise to its member local governments. It provides assistance on local and regional issues pertaining to Economics, Physical and Environmental Planning, and Transportation. As a Virginia Planning District, the HRPDC is also the Affiliate Data Center for the region, providing economic, environmental, transportation, census, and other relevant information to businesses, organizations and citizens.

The HRPDC was contracted by the Virginia DEQ and James City County to develop this implementation plan for the bacteria TMDL for the Mill Creek and Powhatan Creek watersheds. In addition to facilitating the implementation process and developing this report, the HRPDC will continue to 1) facilitate regional cooperation in stormwater and wastewater management, 2) continue to administer regional education programs, 3) maintain the Sanitary Sewer Overflow Reporting System (SSORS), and 4) develop a protocol for future TMDL Implementation Plan development within Hampton Roads.

9.4 James City County

As discussed throughout this document, James City County has the largest role in improving water quality within the Mill Creek and Powhatan Creek Watersheds. Because the Mill Creek and Powhatan Creek watersheds lie completely within the boundaries of James City County, it has jurisdiction over all local projects within the watershed boundaries. The County will continue public programs to treat stormwater runoff, prevent SSOs, and manage land use development to the maximum extent practicable and as required by law. Specific actions that

James City County will implement in order to reduce bacteria concentrations within the Mill Creek and Powhatan Creek Watersheds are outlined in Tables 7-1 and 9-1.

9.5 Private Sector, Non-governmental, and Citizen Groups

9.5.1 James City County Concerned Citizens Coalition (J4C)

The James City County Concerned Citizens Coalition seeks to "coordinate member groups' activities and interests in protecting the County's valuable resources and promoting an enhanced quality of life for its residents." The group was formed in 2006 and lists as members such organizations as the Historic Route 5 Association and the Williamsburg League of Women Voters. A number of neighborhood and homeowner associations in the Mill Creek and Powhatan Creek watersheds are also listed as members. The organization has focused on presenting Community Education Forums on topics of local interest and presenting their research and findings to the Board of Supervisors.

9.5.2 Friends of the Powhatan Creek

The Friends of the Powhatan Creek Watershed is a group of citizens working together to promote responsible stewardship of the Powhatan Creek Watershed in James City County, Virginia. Since 1999, the "grassroots" organization has been committed to the preservation, conservation, and enhancement of the Powhatan Creek Watershed. Under development pressure, the 23-square-mile watershed still harbors rare, threatened, and endangered species and played an integral part in our nation's humble beginnings at Jamestown.

The all-volunteer group undertakes hands-on activities such as citizen water quality monitoring, stream cleanup and underwater grass restoration. Another main focus is to help to implement the Powhatan Creek Watershed Management Plan adopted by the James City County Board of Supervisors. Recently, they assisted in strengthening the Chesapeake Bay Preservation Ordinance and developing Special Stormwater Criteria for sensitive areas. Recently, Friends of Powhatan Creek, along with the JCC Department of Development Management and the Peninsula Housing and Builders Association developed a consensus document at the Builders for the Bay Roundtable. Other initiatives include the Historic Triangle Corridor Enhancement Committee and pursuit of a no-wake zone for the Powhatan Creek.

Table 9-1: Management Actions and Responsible Stakeholders

Management Category	Management Option	Stakeholders Responsible
Sanitary Sewer Improvements	Implementation of SSES Plan	JCSA
	Implement schedule of Regional SSO Consent Order	JCSA
	Participation in HRFOG education program	JCSA/HRPDC
Septic System Programs	CBPA Septic Tank Pump Out and Inspection Information Program	JCC/DCR
	Update septic system locations through pump out program	JCC/DCR
	Field survey to estimate septic system failure rates	JCC
	Implement procedures to address failing septic systems	JCC/VDH
	Develop an onsite wastewater treatment funding program	JCC/VDH/DCR
	Increase enforcement actions for failing systems	VDH
Stormwater QualityPrograms	Enforcement of Illicit Discharge provisions within the Stormwater Management Ordinance	JCC
	County rain barrel rebate program	JCC
	Private BMP Inspection and Maintenance Programs	JCC
	IDDE screening in Mill and Powhatan Creek watersheds	JCC
	Coliscan Monitoring in Mill and Powhatan Creeks	JCC
	Participation in Regional Bacteria Source Tracking Study	JCC
	Estimate Stormwater contribution to bacteria loading	JCC
	Investigate retrofits for wet ponds that would reduce bacteria	JCC
	Retrofit wet ponds to reduce bacteria concentrations	JCC
Boating Programs	Sewer improvements and pumpout facility at County Marina	JCC/VDH
	Expanded Boater Education Program	JCC
	Investigate No Discharge designation for Powhatan Creek	JCC/VDH
	Examine environmental benefits of No Wake Zones	JCC
Pet Waste Programs	Participation in HRSTORM regional education program	JCC/DCR/HRPDC
	County “Scoop the Poop” campaign	JCC/DCR
	Pet waste collectors in County Parks	JCC
	Free pet waste stations for neighborhoods	JCC
	Investigate viability of Pet Waste Ordinance	JCC
Aquatic Resource Restoration	County Stream Restoration Program	JCC
	Add wetlands restoration program	JCC
	Identify areas for sea grass restoration	JCC
Land Use Management	Chesapeake Bay Preservation Area Ordinance	JCC
	Implementation of Special Stormwater Criteria	JCC
	Enforcement JCC Erosion and Sediment Control Ordinance	JCC
	Implementation of JCC Guidelines for Design and Construction of Stormwater Management BMPs	JCC
	PRIDE Program	JCC
	Watershed Plan for Powhatan Creek Watershed	JCC
	Watershed Plan for Mill Creek Watershed	JCC
	Implement bacteria priority areas in Powhatan Watershed	JCC
	Develop special stormwater criteria for Mill Creek Watershed	JCC
	Local Delegation of VSMP	JCC
Wildlife Contribution Controls	BMP Buffer Management	JCC

10.0 RELATED WATERSHED PLANNING EFFORTS

10.1 Watershed Planning Activities

In 2001, James City County hired the Center for Watershed Protection to develop the Powhatan Creek Watershed Management Plan. In 2009, the County hired Vanasse Hangen Brustlin, Inc (VHB) and began the process of developing a watershed management plan for Mill Creek. The Mill Creek Watershed Management Plan will follow the outline and approach established during the development of the Powhatan Creek plan and is expected to be complete during summer 2010.

As part of the James City County watershed planning process, three special studies were performed to gain a better scientific understanding of the Powhatan stream system; these included the stream and floodplain assessment, the conservation area study, and the Stormwater Management Master Plan. The stream and floodplain assessment consisted of an instream habitat survey for the majority of the non-tidal watershed and reported on stream channel stability and habitat conditions in each of the subwatersheds. The conservation area study identified the presence of rare, threatened or endangered (RTE) species, contiguous forest and high quality wetlands and identified potential threats and impacts to their existence. The stormwater master plan developed specific stormwater criteria for subwatersheds, identified existing stormwater practices for retrofit possibilities, and located potential regional stormwater facilities.

The watershed management plan provides a summary of the findings from the Powhatan Creek baseline report, the three special studies, and the stakeholder process conducted by the Center for Watershed Protection, the James River Association and James City County. A specific watershed management plan and accompanying maps were drafted for the twelve subwatersheds based on the eight tools of watershed protection.

The goals of the study were to prevent further degradation of the water quality of Powhatan Creek, maintain the quality of the creek's wetlands, maintain biological and habitat diversity, and promote habitat connectivity. The sub-watershed boundaries of the Powhatan Watershed Plan were compared to the boundaries for the TMDL. The Powhatan TMDL study subwatersheds were delineated to match, to the extent possible, those created for the Powhatan Watershed Plan. This was done to ensure that information developed as a part of the Powhatan TMDL could also be used for implementation of the Powhatan Watershed Plan.

10.2 Adjacent Impaired Waterbodies

Table 10-1: Waterbodies on the 303(d) List within or adjacent to Mill and Powhatan Creek Watersheds

Name of Waterbody	Impaired Segment with HUC	Cause of Impairment/ Va Category	TMDL Deadline	Suspected or Documented Cause
James River Mainstem	All segments –JL29, 30, 33, 35	Fish Consumption - PCB in Fish Tissue/5A	2018	Contaminated Sediments, Source Unknown
James River Mainstem	2 segments – Chickahominy River to Hog Point, JL29, 30, 33	Chloride/5C	2020	Natural Conditions WQ Standards Use Attainability Analysis Needed
James River Mainstem	At Chickahominy River confluence – JL29, 30	Estuarine Bioassessments/5C	2016	Natural Conditions WQ Standards Use Attainability Analysis Needed
James River Mainstem	From Chickahominy River confluence to Skiffes Cr – JL30, 33, 35	Estuarine Bioassessments/5A	2016	Source Unknown
James River Mainstem	All segments –JL29, 30, 33, 35	Aquatic Plants (macrophytes)/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
James River Mainstem	All segments –JL29, 30, 33, 35	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
James River Mainstem	All segments –JL29, 30, 33, 35	Chlorophyll-a/5A	2010	Industrial and Municipal point sources, nonpoint sources (stormwater)
Chickahominy River	Walkers Dam to James River - JL29	Fish Consumption - PCB in Fish Tissue/5A	2018	Contaminated Sediments, Source Unknown

Chickahominy River	Diascund Ck to James River – JL29	Chloride/5C	2016	Natural Conditions WQ Standards Use Attainability Analysis Needed
Chickahominy River	Walkers Dam to James River - JL29	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Chickahominy River	Walkers Dam to James River - JL29	Enterococcus (bacteria)/5A	2020	Source Unknown
College Creek	Tidal Portion – JL34	Enterococcus (bacteria)/5A	2018	Source Unknown
College Creek	Tidal Portion – JL34	Aquatic Plants (macrophytes)/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
College Creek	Tidal Portion – JL34	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Diascund Creek	Diascund Reservoir dam to mouth – JL27	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Gordon Creek	Tidal portion to mouth – JL29	Estuarine Bioassessments/5A	2018	Source Unknown
Gordon Creek	Tidal portion to mouth – JL29	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Little Creek Reservoir	Entire reservoir – JL28	Dissolved Oxygen/5A	2020	Source Unknown
Mill Creek (tributary to Diascund Cr)	Headwaters to tidal limit – JL27	Fecal Coliform/5A	2016	Source Unknown

Mill Creek (tributary to Diascund Cr)	Headwaters to tidal limit – JL27	Dissolved Oxygen/5C	2016	Natural Conditions WQ Standards Use Attainability Analysis Needed
Powhatan Creek	Headwaters to tidal limit – JL31	Benthic – Macroinvertebrates/5A	2014	Source Unknown
Powhatan and Mill Creek	Tidal portion to mouth – JL31, JL33	Enterococcus (bacteria)/5A	2010 – in development	Source Unknown
Powhatan and Mill Creek	Tidal portion to mouth – JL31, JL33	Aquatic Plants (macrophytes)/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Powhatan and Mill Creek	Tidal portion to mouth – JL31, JL33	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Skiffes Creek	From Skiffes Creek Reservoir dam to mouth – JL35	Fish Consumption - PCB in Fish Tissue/5A	2018	Contaminated Sediments, Source Unknown
Skiffes Creek	From Skiffes Creek Reservoir dam to mouth – JL35	Fecal Coliform/5A	2010	Source Unknown
Skiffes Creek	From Skiffes Creek Reservoir dam to mouth – JL35	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Skimino Creek	Barlows Pond dam to mouth – YO65	Fecal Coliform/5A	2010	Source Unknown
Skimino Creek	Barlows Pond dam to mouth – YO65	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Skimino Creek	Barlows Pond dam to mouth – YO65	Aquatic Plants (macrophytes)/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges

Taskinas and Ware Creek	Tidal portions – YO62	Fecal Coliform/5A	2010	Source Unknown
Taskinas and Ware Creek	Tidal portions – YO62	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Taskinas and Ware Creek	Tidal portions – YO62	Aquatic Plants (macrophytes)/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
Yarmouth Creek	Headwaters to tidal limit – JL28	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
York River Mainstem	Both segments – YO63, YO65	Fish Consumption - PCB in Fish Tissue/5A	2018	Source Unknown
York River Mainstem	Both segments – YO63, YO65	Dissolved Oxygen/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges
York River Mainstem	Both segments – YO63, YO65	Aquatic Plants (macrophytes)/5A	2010	Agriculture, Atmospheric Deposition, Clean sediments, Point Sources, Wet weather discharges

11.0 POTENTIAL FUNDING SOURCES

State

Virginia Small Business Environmental Assistance Fund Loan Program
Virginia Resource Authority
Water Quality Improvement Fund
Virginia Clean Water Revolving Loan Fund

Local or Regional

James City County
James City County Capital Improvement Program
Chesapeake Bay Small Watershed Grants Program
Wetlands and Chesapeake Bay Civil Penalties Fund
Hampton Roads Environmental Education Program Mini-Grants

Private Foundations, Non-Profit Organizations, Businesses

National Fish and Wildlife Foundation
Chesapeake Bay Foundation

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